Series 3730
Type 3730-5 Electropneumatic Positioner

With FOUNDATION™ fieldbus communication

FF device rev. 2

FOUNDATION™

Mounting and Operating Instructions

EB 8384-5 EN (1300-1619)

Firmware version 1.56

Edition February 2015

EB + CD

CE Ex Ex certified

Definition of signal words

DANGER!
Hazardous situations which, if not avoided, will result in death or serious injury

WARNING!
Hazardous situations which, if not avoided, could result in death or serious injury

NOTICE
Property damage message or malfunction

Note:
Additional information

Tip:
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Note:
– *Configuration and operation over FOUNDATION™ fieldbus are described in the Configuration Manual ▶ **KH 8384-5 EN**. This Manual is included on the enclosed CD-ROM and is available on our website.*
– *The functions of the **EXPERTplus** Valve Diagnostics are described in the Operating Instructions ▶ **EB 8389 EN**. These Instructions included on the enclosed CD-ROM and is available on our website.*

Firmware revisions (Control R)	
Control R 1.43	**R 1.44 to 1.46**
	Internal revisions
	R 1.52
Diagnostics	All EXPERTplus diagnostic functions are available without having to activate them in the positioner (▶ EB 8389 EN on EXPERTplus Valve Diagnostics).
Additional function blocks	– 2x DO (Discrete Output) – 1x IS (Input Selector) – 1x MAI (Multiple Analog Input) – 1x MAO (Multiple Analog Output) Configuration Manual ▶ KH 8384-5 EN
New functions	In the DO Function Block (Discrete Output), new functions are implemented. Configuration Manual ▶ KH 8384-5 EN
Action on fault detection	If the AO Transducer Block is in O/S mode and the condensed state changes to "Maintenance alarm", the following actions can be started: – Hold the last value – Move valve to fail-safe position – Move to a predefined fault state value Configuration Manual ▶ KH 8384-5 EN
Code 48 extended	The following subitems have been added to Code 48 (see section 14): h0: Activation/deactivation reference test h1: Reference test completed (YES/No) h3: Automatic reset of diagnosis after this time h4: Remaining time until diagnosis reset
	R 1.54 to 1.56
	Internal revisions

Revisions to the communication firmware are listed in the Configuration Manual ▶ KH 8384-5 EN. This Manual is included on the enclosed CD-ROM and is available on our website.

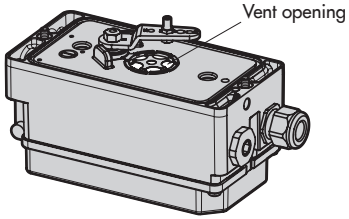
1 Important safety instructions

For your own safety, follow these instructions concerning the mounting, start-up and operation of the positioner:

– The positioner is to be mounted, started up or operated only by trained and experienced personnel familiar with the product. According to these mounting and operating instructions, trained personnel is referred to as individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
– Explosion-protected versions of this positioner are to be operated only by personnel who has undergone special training or instructions or who is authorized to work on explosion-protected devices in hazardous areas. Refer to section 11.
– Any hazards that could be caused in the valve by the process medium, the signal pressure or by moving parts are to be prevented by taking appropriate precautions.
– If inadmissible motions or forces are produced in the pneumatic actuator as a result of the supply pressure level, it must be restricted using a suitable supply pressure reducing station.

To avoid damage to any equipment, the following also applies:

– Do not operate the positioner with the back of the positioner/vent opening facing upwards.The vent opening must not be sealed when the positioner is installed on site.



– Proper shipping and storage are assumed.
– Do not ground electric welding equipment near to the positioner.

Note: *The device with a CE marking fulfills the requirements of the Directive 94/9/EC and the Directive 2004/108/EC.*
The declaration of conformity is included on the enclosed CD-ROM.

2 Article code

Positioner		Type 3730-5	x	x	x	0	x	x	x	x	0	x	0	0	x	0	x	x
With LCD and autotune, FOUNDATION™ fieldbus																		
Explosion protection																		
Without			0															
ATEX II 2G Ex ia IIC T6; II 2D Ex tb IIIC T80°C IP66			1															
CSA Ex ia IIC T6; Class I , II, Div.1, Groups A, B, C, D, E, F, G; Ex nA II T6; Ex nL IIC T6; Class I, II, Div.2, Groups A, B, C, D, E, F, G; Class II, Div.1, Groups E, F, D			3															
FM Class I, Zone 0 AEx ia IIC; Class I, II, III, Div.1, Groups A, B, C, D, E, F, G; Class I, Div.2, Groups A, B, C, D; Class II, Div.2, Groups F, G																		
ATEX II 3G Ex nA II T6; II 3G Ex ic IIC T6; II 3D tc IIIC T80°C IP66			8															
Additional equipment																		
Inductive limit switch	Without			0														
	SJ2-SN (NC contact)			1														
	SJ2-S1N (NO contact)			2														
Solenoid valve	Without				0													
	With, 24 V DC				4													
External position sensor	Without					0												
	With			0		1		0			0							
Leakage sensor	Without						0											
	With						1											
Binary input	Without							0										
	Floating contact					0		1										
Diagnostics																		
EXPERTplus									4									
Housing material																		
Aluminum (standard)											0							
Stainless steel 1.4581						0					1							
Special application																		
Without														0				
Version compatible with paint														1				
Exhaust air port with ¼-18 NPT thread, back of positioner sealed				0	0	0		0						2				
Attachment according to VDI/VDE 3847 including interface														6				
Attachment according to VDI/VDE 3847 prepared for interface														7				
Special version																		
Without																	0	0 0
NEPSI Ex ia IIC T6			1														0	0 9
NEPSI Ex nA II T6, Ex nL IIC T6			8														0	1 0
IECEx Ex ia IIC T6			1														0	1 2
GOST 1Ex ia IIC T6; Ex tb IIIC T80°C Db X, IP66			1														0	1 4
GOST 2Ex nA ic IIC T6/T5/T4 Gc X; Ex tc IIIC T80°C Db X, IP66			8														0	2 0

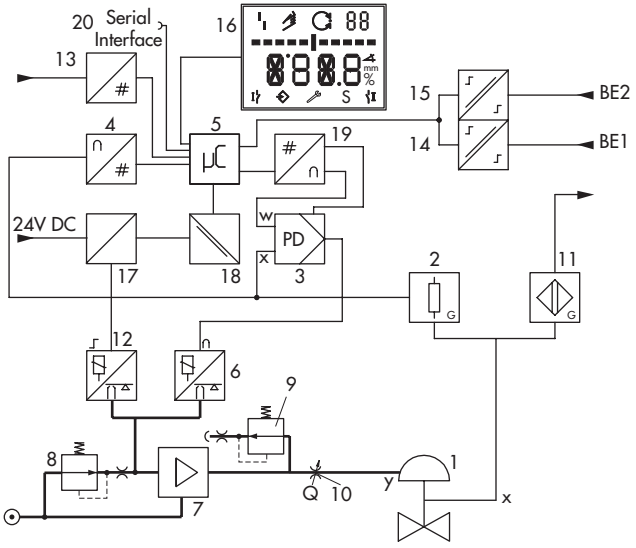
3 Design and principle of operation

The positioner is mounted on pneumatic control valves and is used to assign the valve position (controlled variable x) to the control signal (set point w). The positioner compares the control signal of a control system to the travel or rotational angle of the control valve and issues a signal pressure (output variable y) for the pneumatic actuator.

The positioner mainly consists of an electric travel sensor system, an analog i/p converter with a downstream air capacity booster and the electronics with the microcontroller.

When a system deviation occurs, the actuator is either vented or filled with air. If necessary, the signal pressure change can be slowed down by a volume restriction. The signal pressure supplied to the actuator can be limited by software or on site to 1.4, 2.4 or 3.7 bar.

The fixed flow regulator ensures a constant air flow to the atmosphere, which is used to flush the inside of the positioner housing and to optimize the air capacity booster. The i/p converter is supplied with a constant upstream pressure by the pressure regulator to compensate for any fluctuations in the supply pressure.



1 Control valve
2 Travel sensor
3 PD controller
4 A/D converter
5 Microcontroller
6 i/p converter
7 Air capacity booster
8 Pressure regulator
9 Flow regulator
10 Volume restriction
11* Inductive limit switch
12* Solenoid valve
13 IEC 61158-2 interface module
14 Binary input BI1 (passive)
15* Binary input BI2 (active)
16 Display
17* Actuation of solenoid valve
18* Electrical insulation
19 D/A converter
20 Communication interface
* Options

Fig. 1: *Functional diagram*

The positioner communicates and is powered using IEC 61158-2 transmission technology conforming to FOUNDATION™ fieldbus specification.

As a standard feature, the positioner comes with a binary input used to signalize process information over the FOUNDATION™ fieldbus network.

The extended EXPERTplus diagnostics are integrated into the positioner. They provide information on the positioner and generate diagnostic and status messages, which allow faults to be pinpointed quickly.

The positioner is suitable for the following types of attachment using the corresponding accessories:

- Direct attachment to SAMSON Type 3277 Actuator: section 4.1
- Attachment to actuators according to IEC 60534-6 (NAMUR): section 4.2
- Attachment according to VDI/VDE 3847: section 4.3
- Attachment to Type 3510 Micro-flow Valve: section 4.4
- Attachment to rotary actuators acc. to VDI/VDE 3845: section 4.5

3.1 Additional equipment

Solenoid valve

If the operating voltage for the solenoid valve (12) fails, the supply pressure for the i/p converter is vented to the atmosphere. The positioner can no longer operate and the control valve moves to the fail-safe position determined by the actuator, regardless of the set point.

> ***NOTICE***
> *The manual set point is also reset to 0 % after the solenoid valve is activated!*
> *A different manual set point must be entered again (Code 1).*

Inductive limit switch

In this version, the rotary shaft of the positioner carries an adjustable tag which actuates the built-in proximity switch.

External position sensor

In this version, only the sensor is mounted to the control valve. The positioner is located separately from the valve. The connection of x and y signals to the valve is established by cable and piping for air (only without inductive limit switch).

Leakage sensor

By upgrading the positioner with a leakage sensor, it is possible to detect seat leakage when the valve is in the closed position.

Binary input BI1 (14)

As a standard feature, the positioner comes with a binary input used to signalize process information over the FOUNDATION™ fieldbus network.

Binary input BI2 (15)

This binary input BI2 is optional. It is an active input which is powered by the positioner to connect a floating contact. The switching state of the floating contact can be indicated over the FOUNDATION™ fieldbus network.

Note:
The binary inputs are configured in the DI Function Blocks. Refer to Configuration Manual
▶ KH 8384-5 EN.

3.2 Communication

The positioner is controlled completely by digital signal transmission according to FOUNDATION™ fieldbus specification.

Data are transmitted over the bus using digital, bit-synchronous Manchester coding at a baud rate of 31.25 kbit/s over twisted-pair wires according to IEC 61158-2.

Note:
If complex functions are started in the positioner, which require a long calculation time or lead to a large quantity of data being saved in the volatile memory of the positioner, the alert 'busy' is issued over the DD. This alert is ***not an error message*** *and can be simply confirmed.*

Configuration and operation of the positioner over FOUNDATION™ fieldbus are described in the Configuration Manual ▶ KH 8384-5 EN.

3.2.1 Configuration using the TROVIS-VIEW software

The positioner can be configured with SAMSON's TROVIS-VIEW Configuration and Operator Interface.

The positioner has for this purpose a ***serial interface*** to allow the RS-232 or USB port of a computer to be connected to it over an adapter cable.

The TROVIS-VIEW software enables the user to easily configure the positioner as well as view process parameters online.

Note:
TROVIS-VIEW provides a uniform user interface that allows users to configure and parameterize various SAMSON devices using device-specific database modules. The 3730-5 device module can be downloaded free of charge from our website (www. samson.de) at Services > Software > TROVIS-VIEW. Further information on TROVIS-VIEW (e.g. system requirements) is available on our website and in the Data Sheet ▶ T 6661 EN.

3.2.2 Configuration using the NI-FBUS™ configurator

The positioner can also be configured over the NI-FBUS™ configurator from National Instruments. For this purpose, an interface card must be installed in a computer to connect it to the FOUNDATION™ fieldbus.

The integrated function blocks are linked using the NI-FBUS™ configurator.

3.3 Technical data

Type 3730-5 Positioner (technical data in test certificates additionally apply to explosion-protected devices)		
Rated travel, adjustable		Direct attachment to Type 3277 Actuator: 3.6 to 30 mm Attachment according to IEC 60534-6 (NAMUR): 3.6 to 300 mm Attachment according to VDI/VDE 3847: 3.6 to 300 mm Attachment to rotary actuators (VDI/VDE 3845): 24 to 100° opening angle
Travel range, adjustable		Within the initialized travel/angle of rotation; travel can be restricted to 1/5 at the maximum
Bus connection		Fieldbus interface according to IEC 61158-2, bus-powered Physical Layer Class 113 (without expl. protection) and 111 (expl.-protected version) Field device according to FM 3610 entity, FISCO and FNICO
Commu-nication	Fieldbus	Data transmission conforming to FOUNDATION™ fieldbus specification Communication Profile Class: 31 PS, 32 L Interoperability tested according to Interoperability Test System (ITK 5.2), revision 4.6
	Execution times	PID FB: 20 ms DI FB: 20 ms MAI FB: 50 ms IS FB: 30 ms AO FB: 30 ms DO FB: 30 ms MAO FB: 50 ms
	Local	SAMSON SSP interface and serial interface adapter Software requirements: TROVIS-VIEW with database module 3730-5
Permissible operating voltage		9 to 32 V DC · Powered over bus line Observe the limits in the test certificate for explosion-protected versions.
Maximum operating current		15 mA
Add. current in case of error		0 mA
Supply air		1.4 to 7 bar (20 to 105 psi)
	Air quality acc. to ISO 8573-1	Max. particle size and density: Class 4 · Oil content: Class 3 Moisture and water: Class 3 · Pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected
Signal pressure (output)		0 bar up to the capacity of the supply pressure · Can be limited to 1.4/2.4/3.7 bar ±0.2 bar over software
Characteristic		Linear/equal percentage/reverse equal percentage User-defined (over operating software and communication) Butterfly valve, rotary plug valve or segmented ball valve: Linear/equal percentage Deviation from characteristic ≤ 1 %
Hysteresis		≤0.3 %
Sensitivity		≤0.1 %
Direction of action		Reversible
Air consumption		Independent of supply air < 110 l_n/h
Air output capacity	Filled with air	At Δp = 6 bar: 8.5 m_n^3/h · At Δp = 1.4 bar: 3.0 m_n^3/h · $K_{Vmax(20\ °C)}$ = 0.09
	Vented	At Δp = 6 bar: 14.0 m_n^3/h · At Δp = 1.4 bar: 4.5 m_n^3/h · $K_{Vmax(20\ °C)}$ = 0.15
Perm. ambient temperature		–20 to +80 °C for all versions –45 to +80 °C with metal cable gland –25 to +80 °C with inductive limit switch (SJ2-S1N) and metal cable gland Observe the limits in the test certificate for explosion-protected versions.

Type 3730-5 Positioner (technical data in test certificates additionally apply to explosion-protected devices)			
Influences	Temperature		≤0.15 %/10 K
	Supply air		None
	Effect of vibration		≤0.25 % up to 2000 Hz and 4 g according to IEC 770
EMC			Complying with EN 61000-6-2, EN 61000-6-3, EN 61326-1 and NAMUR Recommendation NE 21
Explosion protection	ATEX	Type 3730-51	II 2G Ex ia IIC T6; II 2D Ex tb IIIC T80°C IP66
		Type 3730-58	II 3G Ex nA II T6; II 3G Ex ic IIC T6; II 3D tc IIIC T80°C IP66
	CSA	Type 3730-53	Ex ia IIC T6; Class I , II, Div.1, Groups A, B, C, D, E, F, G; Ex nA II T6; Ex nL IIC T6; Class I, II, Div.2, Groups A, B, C, D, E, F, G; Class II, Div.1, Groups E, F, D
	FM	Type 3730-53	Class I, Zone 0 AEx ia IIC; Class I, II, III, Div.1, Groups A, B, C, D, E, F, G; Class I, Div.2, Groups A, B, C, D; Class II, Div.2, Groups F, G
	GOST	Type 3730-51	1Ex ia IIC T6; Ex tb IIIC T80°C Db X, IP66
		Type 3730-58	2Ex nA ic IIC T6/T5/T4 Gc X; Ex tc IIIC T80°C Db X, IP66
	IECEx	Type 3730-51	Ex ia IIC T6
	CCoE	Type 3730-5	Ex ia IIC T6
	KCS	Type 3730-51	Ex ia IIC T6/T5/T4
	NEPSI	Type 3730-51	Ex ia IIC T6
		Type 3730-58	Ex nA II T6, Ex nL IIC T6
	STCC	Type 3730-5	0Ex ia IIC T6X; 2Ex s II T6X
	CCoE, INMETRO		On request
Electrical connections			One M20 x 1.5 cable gland for 6 to 12 mm clamping range · Second M20 x 1.5 threaded connection additionally exists · Screw terminals for 0.2 to 2.5 mm² wire cross-sections
Degree of protection			IP 66/NEMA 4X
Use in safety-instrumented systems (SIL)			Observing the requirements of IEC 61508, the systematic capability of the pilot valve for emergency venting as a component in safety-instrumented systems is given.
Emergency venting at 0 V or over the optional solenoid valve			Use is possible on observing the requirements of IEC 61511 and the required hardware fault tolerance in safety-instrumented systems up to SIL 2 (single device/HFT = 0) and SIL 3 (redundant configuration/HFT = 1).
Binary input BI1			
Input			0 to 30 V DC · Reverse polarity protection · Static destruction limit 40 V Current consumption 3.5 mA at 24 V, galvanic isolation
Signal			Signal '1' at Ue > 5 V · Signal '0' at Ue < 3 V

Materials	
Housing	Die-cast aluminum EN AC-AlSi12(Fe) (EN AC-44300) acc. to DIN EN 1706 chromated and powder paint coated · Special version: stainless steel 1.4581
External parts	Stainless steel 1.4571 and 1.4301
Cable gland	M20x1.5, black polyamide
Weight	Approx. 1.0 kg

Options for Type 3730-5

Binary input BI2 for floating contact	
Switching input	R < 100 Ω · Contact load 100 mA · Static destruction limit 20 V/5.8 mA Galvanic isolation
Solenoid valve · Approval according to IEC 61508/SIL	
Input	24 V DC · Reverse polarity protection · Static destruction limit 40 V Current consumption $I = \frac{U - 5.7\ V}{3840\ \Omega}$ (corresponding to 4.8 mA at 24 V/114 mW)
Signal '0' (no response)	<12 V (emergency venting at 0 V)
Signal '1' (response)	> 19 V
Service life	> 5 x 10^6 switching cycles
K_V coefficient	0.15
Inductive limit switch	For connection to switching amplifier acc. to EN 60947-5-6
SJ2-SN proximity switch	NAMUR NC contact
SJ2-S1N proximity switch	NAMUR NO contact
External position sensor	
Travel	Same as positioner
Cable	10 m · Flexible and durable · With M12x1 connector · Flame-retardant acc. to VDE 0472 · Resistant to oils, lubricants and coolants as well as other aggressive media
Permissible ambient temperature	–60 to +105 °C
Immunity to vibration	Up to 10 g in the range of 10 to 2000 Hz
Degree of protection	IP 67
Leakage sensor · Suitable for operation in hazardous areas	
Temperature range	–40 to +130 °C
Tightening torque	20 ±5 Nm

4 Attachment to the control valve – Mounting parts and accessories

NOTICE

Risk of malfunction due to incorrect sequence of mounting, installation and start-up!

Keep the following sequence.

1. *Remove the protective film from the pneumatic connections.*
2. *Mount the positioner on the control valve.*
3. *Connect the supply air.*
4. *Connect the electrical power.*
5. *Perform the start-up settings.*

The positioner is suitable for the following types of attachment:

- Direct attachment to SAMSON Type 3277 Actuator
- Attachment to actuators according to IEC 60534-6 (NAMUR)
- Attachment according to VDI/VDE 3847
- Attachment to Type 3510 Micro-flow Valve
- Attachment to rotary actuators

NOTICE

Risk of malfunction due to incorrect mounting parts/accessories or incorrect assignment of lever and pin position.

Attach the positioner to the control valve only using the mounting parts and accessories as specified in Table 1 to Table 6. Observe the type of attachment.

Observe the assignment between lever and pin position (see travel tables on page 17).

Lever and pin position

The positioner is adapted to the actuator and to the rated travel by the lever on the back of the positioner and the pin inserted into the lever.

The travel tables on page 17 show the maximum adjustment range at the positioner. The travel that can be implemented at the valve is additionally restricted by the selected fail-safe position and the required compression of the actuator springs.

The positioner is equipped with the M lever (pin position 35) as standard.

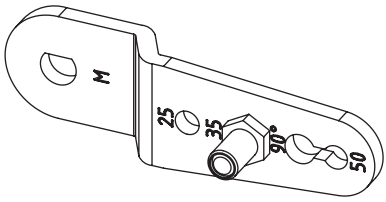


Fig. 2: *M lever with pin position 35*

NOTICE

Risk of malfunction because the newly mounted lever has not been adapted to the internal measuring lever.

Move the newly mounted lever (1) once all the way as far as it will go in both directions.

Travel tables

Note:
The **M** *lever is included in the scope of delivery.*
S, L, XL levers for attachment according to IEC 60534-6 (NAMUR) are available as accessories (see Table 3).

Direct attachment to Type 3277-5 and Type 3277 Actuators

Actuator size [cm²]	Rated travel [mm]	Adjustment range at positioner [1] Travel [mm]			Required lever	Assigned pin position
120	7.5	5.0	to	25.0	M	25
120/175/240/350	15	7.0	to	35.0	M	35
355/700/750	30	10.0	to	50.0	M	50

Attachment according to IEC 60534-6 (NAMUR)

SAMSON valves with Type 3271 Actuator		Adjustment range at positioner [1] Other control valves		Required lever	Assigned pin position
Actuator size [cm²]	Rated travel [mm]	Min. travel [mm]	Max. travel [mm]		
60 and 120 with Type 3510 Valve	7.5	3.6	18.0	S	17
120	7.5	5.0	25.0	M	25
120/175/240/350	15	7.0	35.0	M	35
700/750	7.5				
355/700/750	15 and 30	10.0	50.0	M	50
1000/1400/2800	30	14.0	70.0	L	70
	60	20.0	100.0	L	100
1400/2800	120	40.0	200.0	XL	200

Rotary actuators Opening angle			Required lever	Assigned pin position
24	to	100°	M	90°

[1] The min./max. adjustment range is based on the ***NOM* (nominal range)** initialization mode

4.1 Direct attachment

4.1.1 Type 3277-5 Actuator

– *Required mounting parts and accessories: Table 1 on page 46*
– *Observe the travel table on page 17.*

Actuator with 120 cm² (see Fig. 3)

Depending on the type of positioner attachment, the signal pressure is routed either left or right of the yoke through a hole to the actuator diaphragm. Depending on the failsafe action of the actuator "actuator stem extends" or "actuator stem retracts" (valve closes or opens upon supply air failure), the switchover plate (9) must first be attached to the actuator yoke. Align the switchover plate with the corresponding symbol for left or right attachment according to the marking (view looking onto the switchover plate).

1. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges on the positioner, making sure the two seals are seated properly.
2. Remove screw plug (4) on the back of the positioner and seal the signal pressure output (38) on the connecting plate (6) or on the pressure gauge bracket (7) with the stopper (5) included in the accessories.
3. Place follower clamp (3) on the actuator stem, align it and screw tight so that the mounting screw is located in the groove of the actuator stem.
4. Mount cover plate (10) with narrow side of the cut-out (Fig. 3, on the left) pointing towards the signal pressure connection. Make sure that the gasket (14) points towards the actuator yoke.
5. **15 mm travel:** Keep the follower pin (2) on the **M** lever (1) on the back of the positioner in the pin position **35** (delivered state).
   7.5 mm travel: Remove the follower pin (2) from the pin position **35**, reposition it in the hole for pin position **25** and screw tight.
6. Insert formed seal (15) into the groove of the positioner housing and insert the seal (10.1) on the back of the housing.
7. Place positioner on the cover plate (10) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or rotary pushbutton. The lever (1) must rest on the follower clamp with spring force. Mount the positioner on the cover plate (10) using the two fixing screws.

> ***Note applying to all types of attachment except for direct attachment to Type 3277-5:***
> *The signal pressure output at the back must be sealed by the screw plug (4, order no. 0180-1254) and the associated O-ring (order no. 0520-0412).*

8. Mount cover (11) on the other side. Make sure that the vent plug is located at the bottom when the control valve is installed to allow any condensed water that collects to drain off.

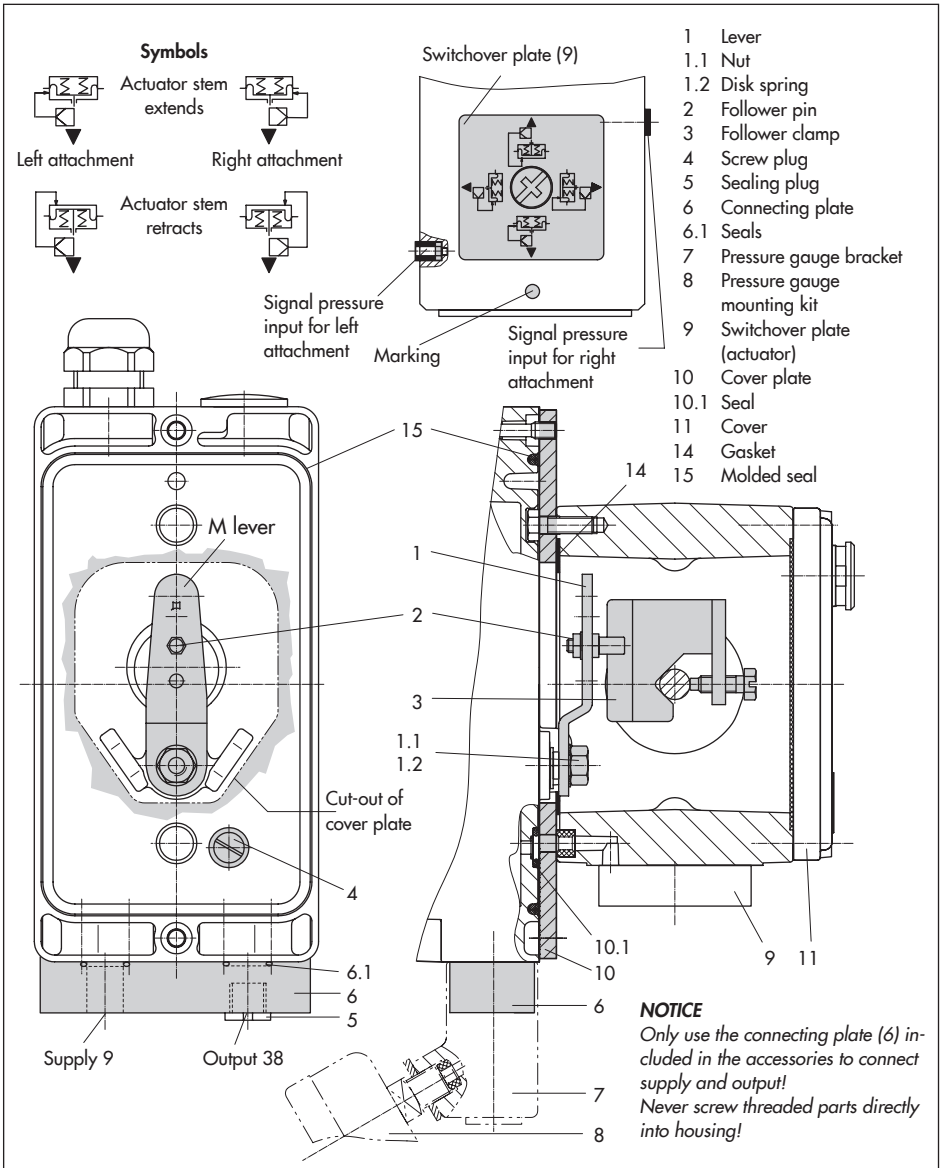


Fig. 3: *Direct attachment – Signal pressure connection for Type 3277-5 Actuator with 120 cm²*

4.1.2 Type 3277 Actuator

– *Required mounting parts and accessories: Table 2 on page 47*
– *Observe the travel table on page 17.*

Actuators with 175 to 750 cm² effective areas (see Fig. 4)

Mount the positioner on the yoke. The signal pressure is routed to the actuator over the connection block (12), for actuators with fail-safe action "actuator stem extends" internally through a hole in the valve yoke and for "actuator stem retracts" through an external pipe.

1. Place follower clamp (3) on the actuator stem, align it and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Mount cover plate (10) with narrow side of the cut-out (Fig. 4, on the left) pointing towards the signal pressure connection. Make sure that the gasket (14) points towards the actuator yoke.
3. For actuators with 355, 700 or 750 cm², remove the follower pin (2) on the **M** lever (1) on the back of the positioner from pin position **35**, reposition it in the hole for pin position **50** and screw tight.
   For actuators 175, 240 and 350 cm² with 15 mm travel, keep the follower pin (2) in pin position **35**.
4. Insert formed seal (15) into the groove of the positioner housing.
5. Place positioner on the cover plate in such a manner that the follower pin (2) rests on the top of the follower clamp (3).
   Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or rotary pushbutton. The lever (1) must rest on the follower clamp with spring force. Mount the positioner on the cover plate (10) using the two fixing screws.
6. Make sure that the tip of the gasket (16) projecting from the side of the connection block is positioned to match the actuator symbol for the actuator's fail-safe action "actuator stem extends" or "actuator stem retracts". If this is not the case, unscrew the three fastening screws and lift off the cover. Turn the gasket (16) by 180° and re-insert it.
   The old connection block version (Fig. 4, bottom) requires the switch plate (13) to be turned to align the actuator symbol with the arrow marking.
7. Place the connection block (12) with the associated seals against the positioner and the actuator yoke and fasten using the screw (12.1). For actuators with fail-safe action "actuator stem retracts", additionally remove the stopper (12.2) and mount the external signal pressure pipe.
8. Mount cover (11) on the other side. Make sure that the vent plug is located at the bottom when the control valve is installed to allow any condensed water that collects to drain off.

1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Follower clamp
10 Cover plate
11 Cover
11.1 Vent plug
12 Connection block
12.1 Screw
12.2 Stopper or connection for external piping
13 Switch plate
14 Gasket
15 Formed seal
16 Gasket

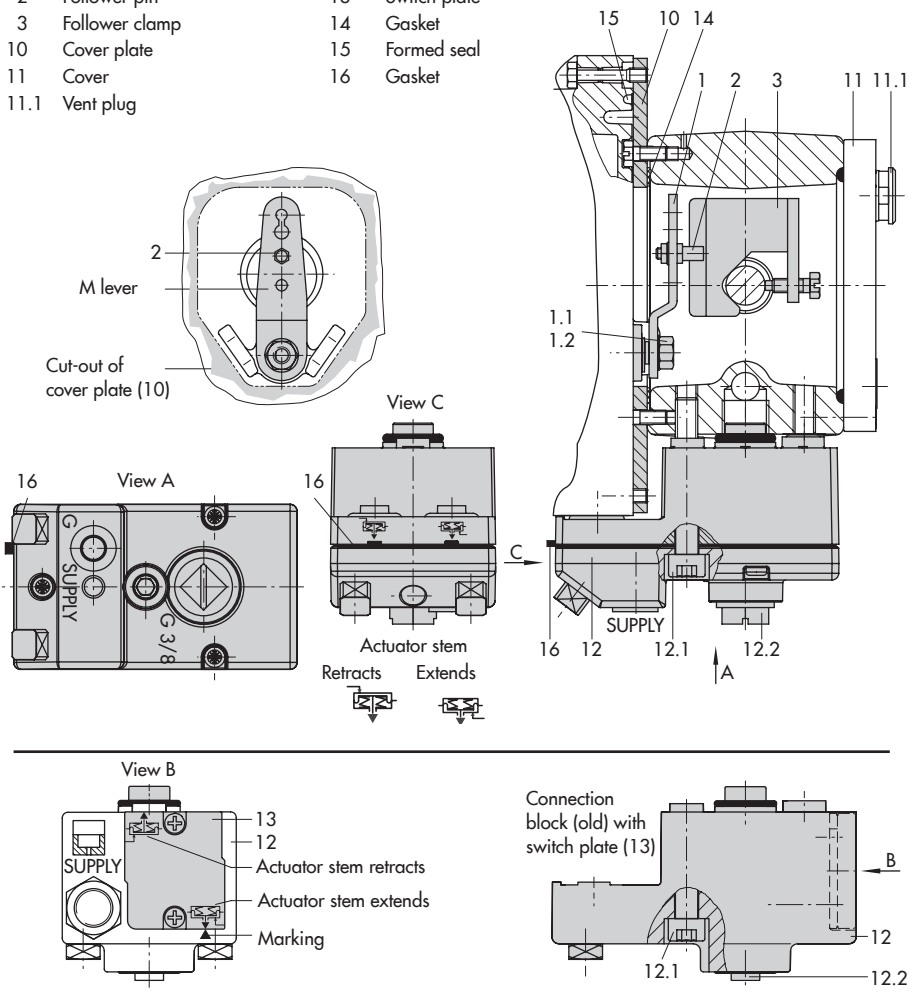


Fig. 4: *Direct attachment – Signal pressure connection for Type 3277 Actuator with 175 to 750 cm²*

4.2 Attachment according to IEC 60534-6

– *Required mounting parts and accessories: Table 3 on page 48*
– *Observe the travel table on page 17.*

Fig. 5

The positioner is attached to the control valve using a NAMUR bracket (10).

1. Screw the two bolts (14) to the bracket (9.1) of the stem connector (9), place the follower plate (3) on top and use the screws (14.1) for fastening.

   Actuator sizes 2800 cm² and 1400 cm² with 120 mm travel:
   – For a travel of 60 mm or smaller, screw the longer follower plate (3.1) directly to the stem connector (9).
   – For a travel exceeding 60 mm, mount the bracket (16) first and then the follower plate (3) to the bracket together with the bolts (14) and screws (14.1).
2. Mount NAMUR bracket (10) to the control valve as follows:
   – For **attachment to the NAMUR rib**, use an M8 screw (11) and toothed lock washer directly in the yoke hole.
   – For attachment to **valves with rod-type yokes**, use two U-bolts (15) around the yoke. Align the NAMUR bracket (10) according to the embossed scale so that the follower plate (3) is shifted by half the angle range to the NAMUR bracket (the slot of the follower plate is centrally aligned with the NAMUR bracket at mid valve travel).
3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges on the positioner, making sure the two seals (6.1) are seated properly.
4. Select required lever size (1) **M**, **L** or **XL** and pin position according to the actuator size and valve travel listed in the travel table on page 17.

Should a pin position other than position **35** with the standard **M** lever be required, or an **L** or **XL** lever size be required, proceed as follows:

5. Screw the follower pin (2) in the assigned lever hole (pin position as specified in the travel table). Only use the longer follower pin (2) included in the mounting kit.
6. Place the lever (1) on the shaft of the positioner and fasten it tight using the disk spring (1.2) and nut (1.1).
   Move lever once all the way as far as it will go in both directions.
7. Place positioner on the NAMUR bracket in such a manner that the follower pin (2) rests in the slot of the follower plate (3, 3.1). Adjust the lever (1) correspondingly.
   Screw the positioner to the NAMUR bracket using both its mounting screws.

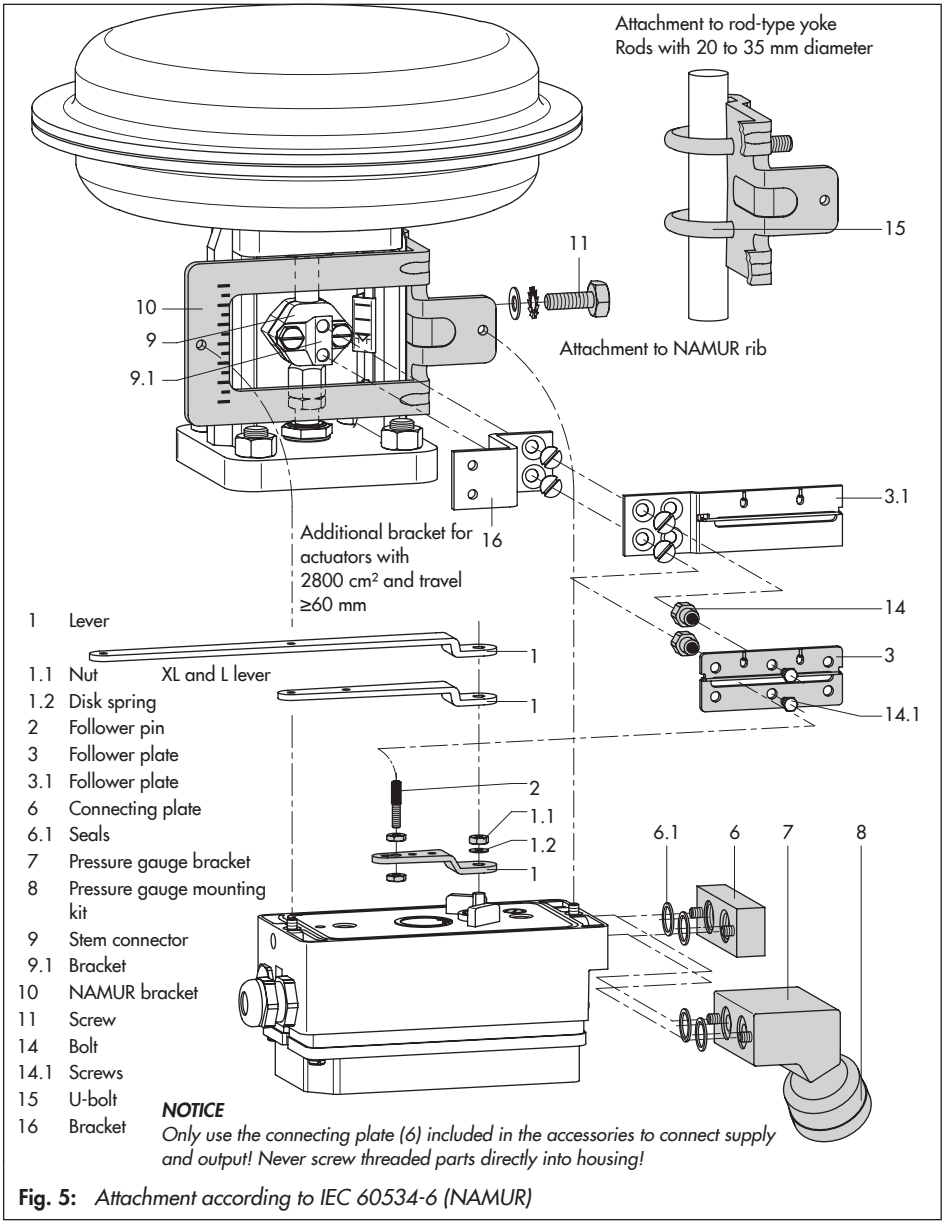


Fig. 5: *Attachment according to IEC 60534-6 (NAMUR)*

4.3 Attachment according to VDI/VDE 3847

Type 3730-5xxx0xxxx0x0060xx and Type 3730-5xxx0xxxx0x0070xx Positioners with air purging of the actuator's spring chamber can be attached according to VDI/VDE 3847.

Type 3730-5xxx0xxxx0x0000xx Positioner without air purging of the actuator's spring chamber can be attached according to VDI/VDE 3847.

This type of attachment allows the positioner to be replaced quickly while the process is running by blocking the air in the actuator.

The signal pressure can be blocked in the actuator by unscrewing the red retaining screw (20) and then turning the air blocker (19) on the bottom of the adapter block.

Attachment to Type 3277 Actuator (see Fig. 6)

– Required mounting parts and accessories: Table 4 on page 48

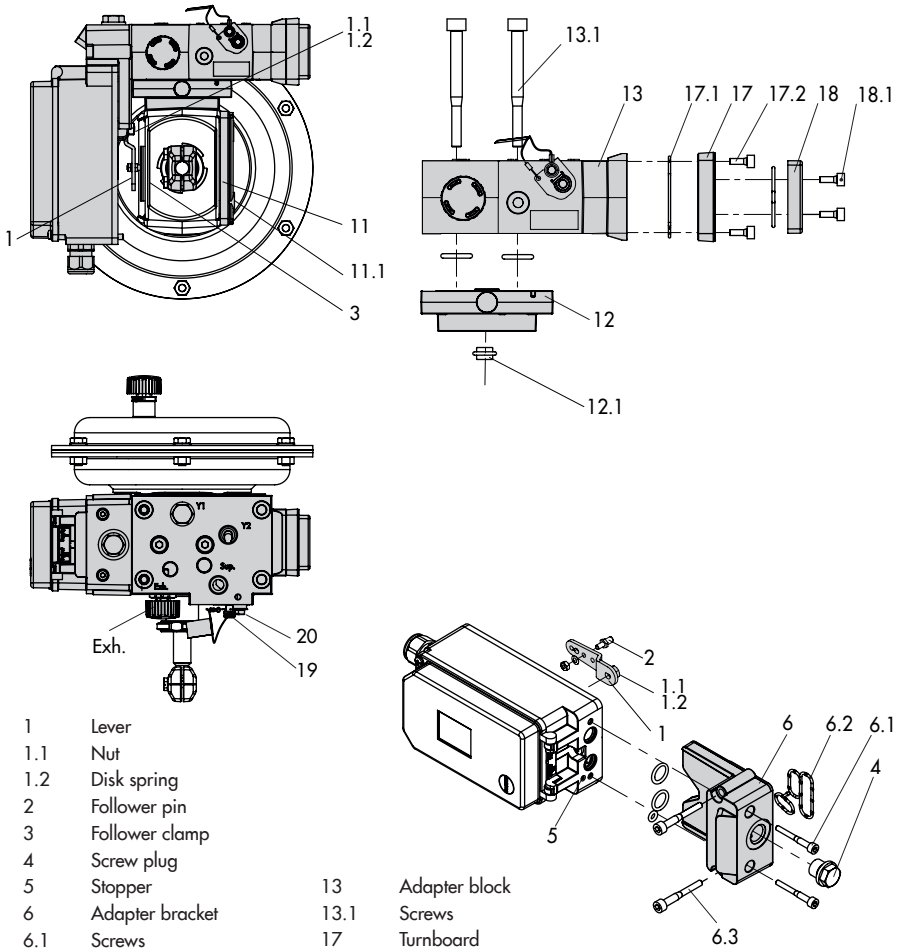
Mount the positioner on the yoke as shown in Fig. 6. The signal pressure is routed to the actuator over the connecting plate (12), for actuators with fail-safe action "actuator stem extends" internally through a bore in the valve yoke and for "actuator stem retracts" through external piping.

Only the Y1 port is required for positioner attachment. The Y2 port can be used for air purging of the spring chamber.

1. Place follower clamp (3) on the actuator stem, align it and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Place the adapter bracket (6) on the positioner and mount using the screws (6.1). Make sure that the seals are correctly seated. For positioners **with air purging**, remove the stopper (5) before mounting the positioner. For positioners **without air purging**, replace the screw plug (4) with a vent plug.
3. For actuators with 355, 700 or 750 cm², remove the follower pin (2) on the M lever (1) on the back of the positioner from pin position 35, reposition it in the hole for pin position 50 and screw tight.

   For actuators 175, 240 and 350 cm² with 15 mm travel, keep the follower pin (2) in pin position 35.
4. Insert the formed seal (6.2) in the groove of the adapter bracket (6).
5. Insert the formed seal (17.1) into the turnboard (17) and mount the turnboard to the adapter block (13) using the screws (17.2).
6. Mount the blank plate (18) to the turnboard (17) using the screws (18.1). Make sure that the seals are correctly seated.

Note:
A solenoid valve can also be mounted in place of the blank plate (18). The orientation of the turnboard (17) determines the mounting position of the solenoid valve. Alternatively, a restrictor plate can be mounted (▶ AB 11 EN).



1	Lever	13	Adapter block
1.1	Nut	13.1	Screws
1.2	Disk spring	17	Turnboard
2	Follower pin	17.1	Formed seal
3	Follower clamp	17.2	Screws
4	Screw plug	18	Blank plate
5	Stopper	18.1	Screws
6	Adapter bracket	19	Air blocker
6.1	Screws	20	Retaining screw
6.2	Formed seal		
6.3	Screws		
11	Cover		
11.1	Vent plug		
12	Connecting plate		
12.1	Seal		

Fig. 6: *Attachment according to VDI/VDE 3847 to Type 3277 Actuator*

7. Insert the screws (13.1) through the middle holes of the adapter block (13).
8. Place the connecting plate (12) together with the seal (12.1) onto the screws (13.1) corresponding to the fail-safe action "actuator stem extends" or "actuator stem retracts". The fail-safe action that applies is determined by aligning the groove of the adapter block (13) with the groove of the connecting plate (12) (Fig. 7).

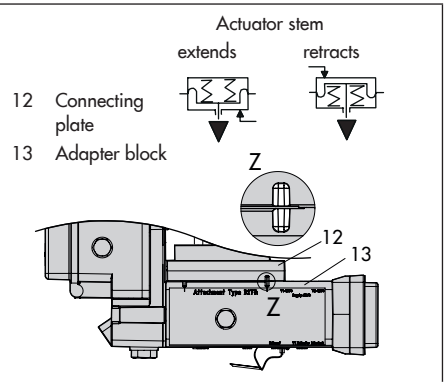


Fig. 7: *Fail-safe position*

9. Mount the adapter block (13) together with the connecting plate (12) to the actuator using the screws (13.1).
10. Insert the vent plug (11.1) into the **Exh.** connection.
11. For fail-safe action "actuator stem extends", seal the Y1 port with a blanking plug.

    For fail-safe action "actuator stem retracts", connect the Y1 port to the signal pressure connection of the actuator.

    Place positioner on the adapter block (13) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or rotary pushbutton.

    The lever (1) must rest on the follower clamp with spring force.

    Fasten the positioner to the adapter block (13) using the two fixing screws (6.3). Make sure the formed seal (6.2) is properly seated.
12. Mount cover (11) on the other side to the yoke. Make sure that the vent plug is located at the bottom when the control valve is installed to allow any condensed water that collects to drain off.

Attachment to NAMUR rib (see Fig. 8)

– Required mounting parts and accessories: Table 4 on page 48
– Observe the travel table on page 17.

1. **Series 240 Valves, actuator size up to 1400-60 cm²:** Screw the two bolts (14) to the bracket of the stem connector or directly to the stem connector (depending on the version), place the follower plate (3) on top and use the screws (14.1) to fasten it.

   Type 3251 Valve, 350 to 2800 cm²: Screw the longer follower plate (3.1) to the bracket of the stem connector or directly to the stem connector (depending on the version).

   Type 3254 Valve, 1400-120 to 2800 cm²: Screw the two bolts (14) to the bracket (16). Fasten the bracket (16) onto the stem connector, place the follower plate (3) on top and use the screws (14.1) to fasten it.

   Mount the positioner on the NAMUR rib as shown in Fig. 8.

2. For **attachment to the NAMUR rib**, fasten the NAMUR connection block (10) directly into the existing yoke bore using the screw and toothed lock washer (11). Align the marking on the NAMUR valve connection (on the side marked '1') to 50 % travel.

   For attachment to **valves with rod-type yokes**, use the two U-bolts (15) around the yoke. Fasten the NAMUR connection block (10) directly into the existing yoke bore using the screw and toothed lock washer (11). Align the marking on the NAMUR valve connection (on the side marked '1') to 50 % travel.

3. Place the adapter bracket (6) on the positioner and mount using the screws (6.1). Make sure that the seals are correctly seated. For positioners **with air purging**, remove the stopper (5) before mounting the positioner. For positioners **without air purging**, replace the screw plug (4) with a vent plug.

4. Select required lever size (1) M, L or XL and pin position according to the actuator size and valve travel listed in the travel table on page 17.

Should a pin position other than position 35 with the standard M lever be required, or an L or XL lever size be required, proceed as follows:

– Screw the follower pin (2) in the assigned lever hole (pin position as specified in the travel table). Only use the longer follower pin (2) included in the mounting kit.
– Place the lever (1) on the shaft of the positioner and fasten it tight using the disk spring (1.2) and nut (1.1).
– Move lever once all the way as far as it will go in both directions.

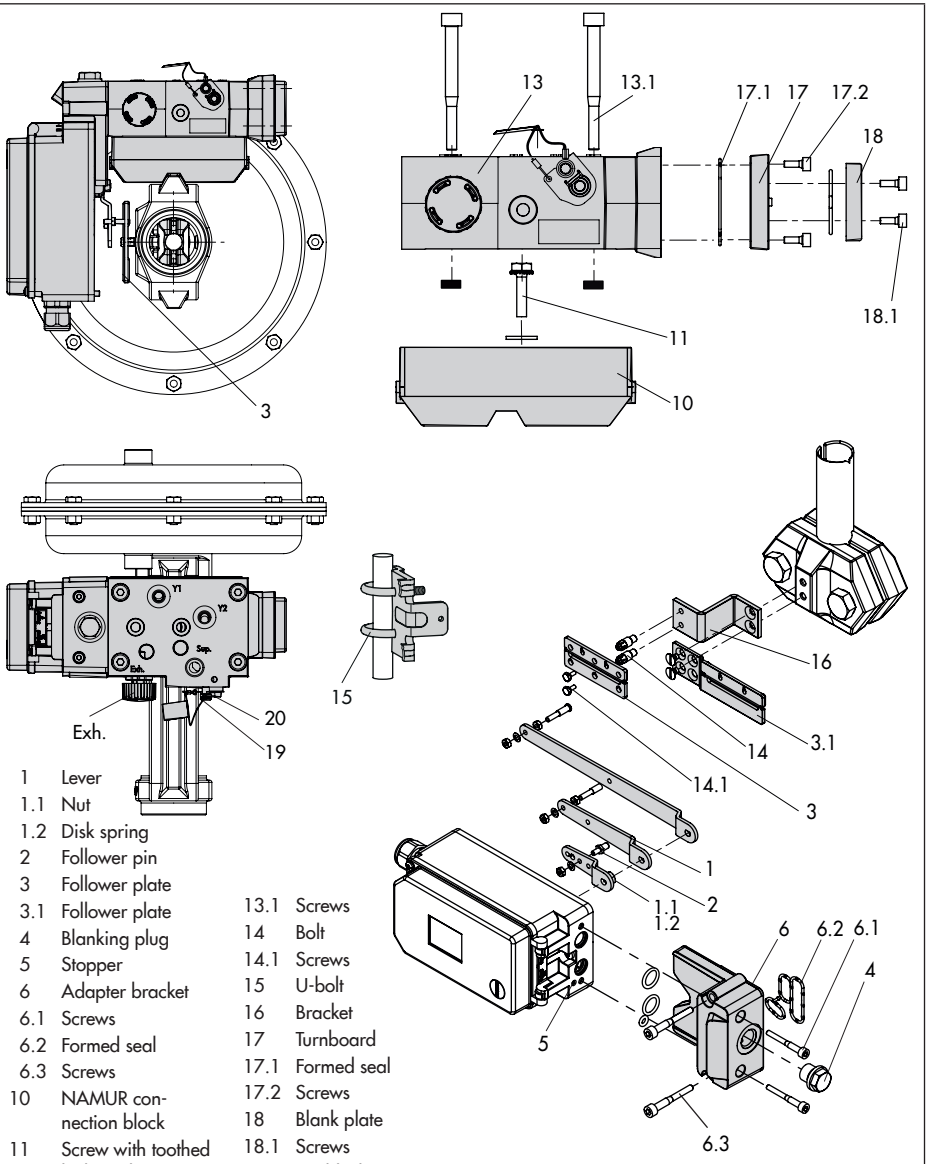
5. Insert the formed seal (6.2) in the groove of the adapter bracket.
6. Insert the formed seal (17.1) into the turnboard (17) and mount the turnboard to the adapter block (13) using the screws (17.2).
7. Mount the blank plate (18) to the turnboard using the screws (18.1). Make sure that the seals are correctly seated.

Note:
A solenoid valve can also be mounted in place of the blank plate (18). The orientation of the turnboard (17) determines the mounting position of the solenoid valve. Alternatively, a restrictor plate can be mounted (▶ AB 11 EN).

8. Fasten the adapter block (13) to the NAMUR connection block using the screws (13.1).
9. Insert the vent plug into the Exh. connection.
10. Place the positioner on the adapter block (13) in such a manner that the follower pin (2) rests on the top of the follower plate (3, 3.1). Adjust the lever (1) correspondingly.

    Fasten the positioner to the adapter block (13) using the two fixing screws (6.3). Make sure the formed seal (6.2) is properly seated.
11. For **single-acting actuators without air purging**, connect the Y1 port of the adapter block to the signal pressure connection of the actuator. Seal the Y2 port with a blanking plug.

    For **double-acting actuators and actuators with air purging**, connect the Y2 port of the adapter block to the signal pressure connection of the second actuator chamber or spring chamber of the actuator.



1	Lever	13.1	Screws
1.1	Nut	14	Bolt
1.2	Disk spring	14.1	Screws
2	Follower pin	15	U-bolt
3	Follower plate	16	Bracket
3.1	Follower plate	17	Turnboard
4	Blanking plug	17.1	Formed seal
5	Stopper	17.2	Screws
6	Adapter bracket	18	Blank plate
6.1	Screws	18.1	Screws
6.2	Formed seal	19	Air blocker
6.3	Screws	20	Retaining screw
10	NAMUR connection block		
11	Screw with toothed lock washer		
13	Adapter block		

Fig. 8: *Attachment according to VDI/VDE 3847 to a NAMUR rib*

4.4 Attachment to Type 3510 Micro-flow Valve

Fig. 9

– *Required mounting parts and accessories: Table 3 on page 48*
– *Observe the travel table on page 17.*

The positioner is attached to the valve yoke using a bracket.

1. Fasten the bracket (9.1) to the stem connector.
2. Screw the two bolts (9.2) to the bracket (9.1) of the stem connector (9), place the follower plate (3) on top and use the screws (9.3) for fastening.
3. Mount the travel indication scale (accessories) to the outer side of the yoke using the hex screws (12.1), ensuring that the scale is aligned with the stem connector.
4. Fasten the hex bar (11) onto the outer side of yoke by screwing the M8 screws (11.1) directly into the holes on the yoke.
5. Fasten the bracket (10) to the hex bar (11) using the hex screw (10.1), washer and tooth lock washer.
6. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges on the positioner, making sure the two seals are seated properly.
7. Unscrew the standard M lever (1) including follower pin (2) from the positioner shaft.
8. Take the S lever (1) and screw the follower pin (2) in the hole for pin position 17.
9. Place the S lever on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).
   Move lever once all the way as far as it will go in both directions.
10. Place positioner on the bracket (10) in such a manner that the follower pin slides into the groove of the follower pin (3). Adjust the lever (1) correspondingly. Screw the positioner to the bracket (10) using both its screws.

4.5 Attachment to rotary actuators

Fig. 11

– *Required mounting parts and accessories: Table 5 on page 49*
– *Observe the travel table on page 17.*

The positioner is mounted to the rotary actuator using two pairs of brackets.

Prior to attaching the positioner to the SAMSON Type 3278 Rotary Actuator, mount the associated adapter (5) to the free end of the rotary actuator shaft.

Note:
On attaching the positioner as described below, it is imperative that the actuator's direction of rotation is observed.

1. Place follower clamp (3) on the slotted actuator shaft or adapter (5).

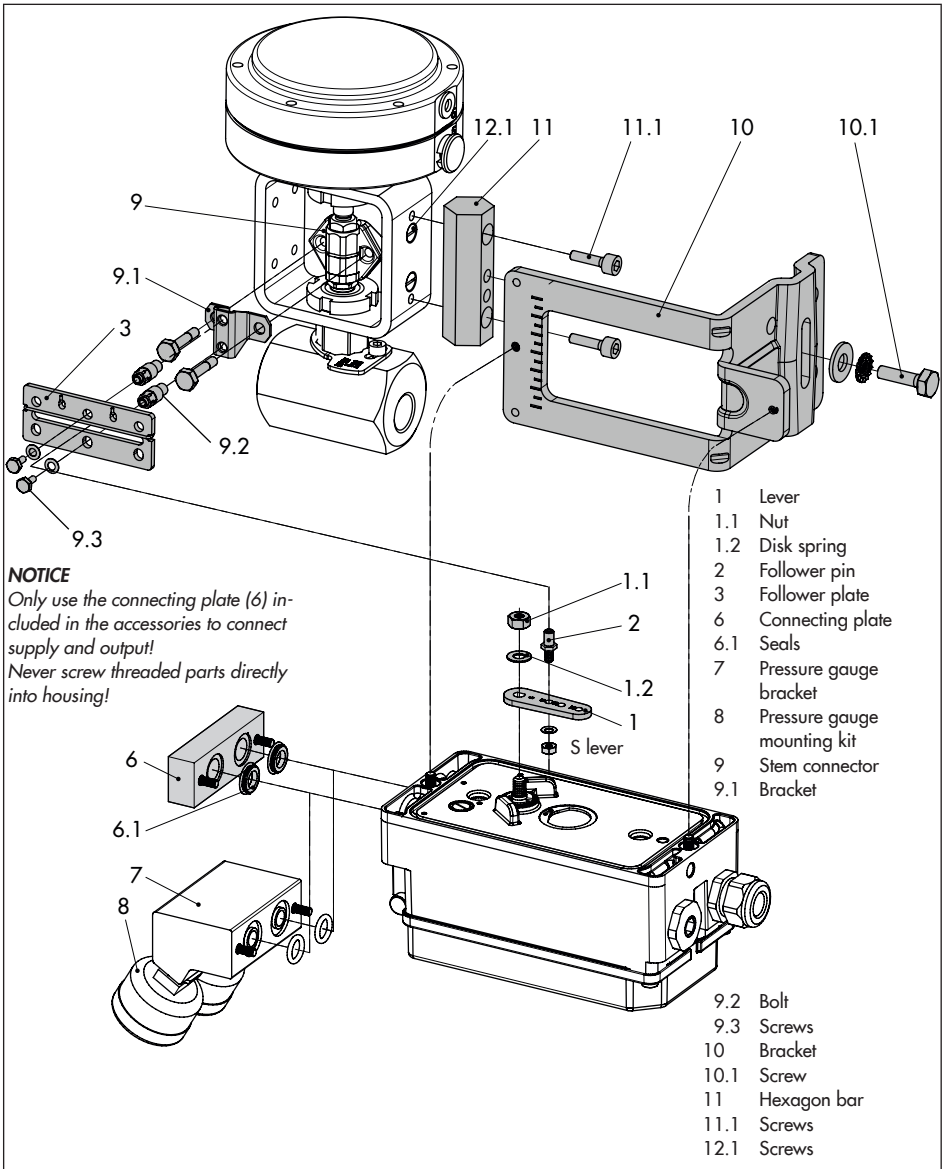


Fig. 9: *Attachment to Type 3510 Micro-flow Valve*

2. Place coupling wheel (4) with flat side facing the actuator on the follower clamp (3). Refer to Fig. 11 to align slot so that it matches the direction of rotation when the valve is in its closed position.
3. Fasten the coupling wheel (4) and follower clamp (3) tightly onto the actuator shaft using screw (4.1) and disk spring (4.2).
4. Fasten the bottom pair of brackets (10.1) with the bends pointing either facing to the inside or to the outside (depending on the actuator size) onto the actuator housing. Position the top pair of brackets (10) and fasten.
5. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges on the positioner, making sure the two seals are seated properly. **Double-acting** springless rotary actuators require the use of a reversing amplifier on the connection side of the positioner housing (see section 4.6).
6. Unscrew the standard follower pin (2) from the positioner's **M** lever (1). Use the metal follower pin (Ø 5 mm) included in the mounting kit and screw tight into the hole for pin position **90°**.
7. Place positioner on the top bracket (10) and fasten tight. Taking the actuator's direction of rotation into account, adjust lever (1) so that it engages in the slot of the coupling wheel (4) with its follower pin (Fig. 11). It must be guaranteed that the lever (1) is parallel to the long side of the positioner when the actuator is at half its angle of rotation.
8. Stick the scale plate (4.3) on the coupling wheel so that the arrow tip indicates the closed position and it can be easily read when the valve is installed.

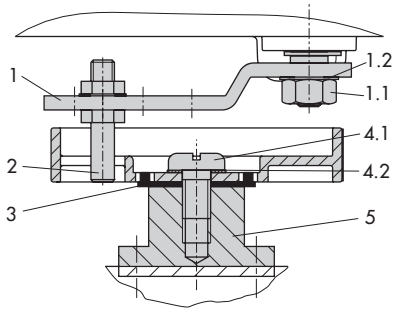


Fig. 10: *Mounting the coupling wheel on Type 3278*

4.5.1 Heavy-duty version

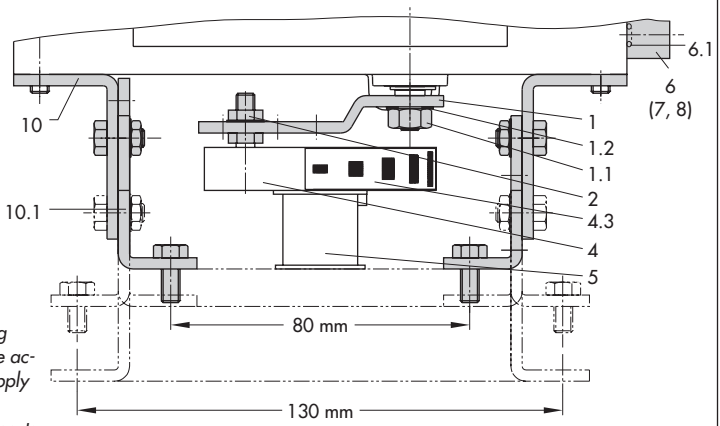
Fig. 12

– *Required mounting parts and accessories: Table 5 on page 49*

Both mounting kits contain all the necessary mounting parts. The parts for the actuator size used must be selected from the mounting kit.

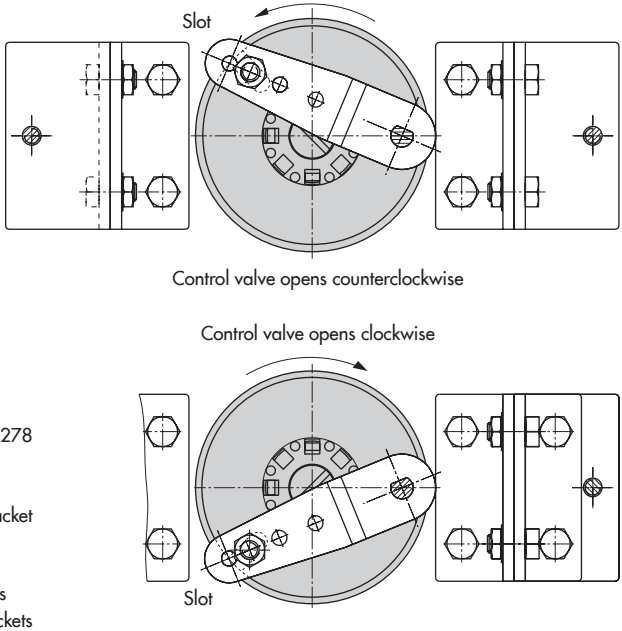
Prepare actuator, and mount required adapter supplied by the actuator manufacturer, if necessary.

1. Mount the housing (10) onto the rotary actuator. In case of VDI/VDE attachment,



NOTICE

Only use the connecting plate (6) included in the accessories to connect supply and output!
Never screw threaded parts directly into housing!



Legend for Fig. 10 and Fig. 11

1	Lever
1.1	Nut
1.2	Disk spring
2	Follower pin
3	Follower clamp (Fig. 10)
4	Coupling wheel
4.1	Screw
4.2	Disk spring
4.3	Scale plate
5	Actuator shaft Adapter for Type 3278
6	Connecting plate
6.1	Seals
7	Pressure gauge bracket
8	Pressure gauge mounting kit
10	Top pair of brackets
10.1	Bottom pair of brackets

Fig. 11: *Attachment to rotary actuators*

place spacers (11) underneath, if necessary.

2. For **SAMSON Type 3278 and VETEC S160 Rotary Actuators**, screw the adapter (5) onto the free end of the shaft or place adapter (5.1) onto the shaft of the **VETEC R Actuator**. Place adapter (3) onto **Type 3278, VETEC S160 and VETEC R Actuators**. For **VDI/VDE version**, this step depends on the actuator size.
3. Stick adhesive label (4.3) onto the coupling in such a manner that the yellow part of the sticker is visible in the window of the housing when the valve is OPEN. Adhesive labels with explanatory symbols are enclosed and can be stuck on the housing, if required.
4. Fasten coupling (4) on the slotted actuator shaft or adapter (3) using screw (4.1) and disk spring (4.2).

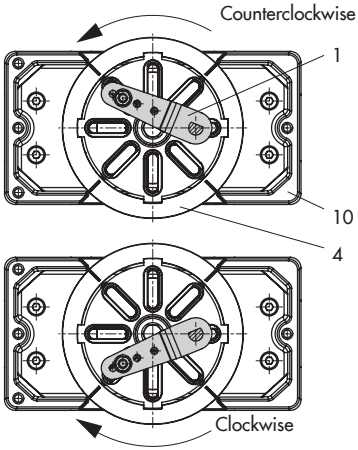


Fig. 13: *Direction of rotation*

5. Unscrew the standard follower pin (2) from the positioner's M lever (1). Attach the follower pin (Ø 5 mm) included in the mounting kit to pin position 90°.
6. Mount connecting plate (6) for required G ¼ connecting thread or pressure gauge bracket (7) with pressure gauges on the positioner, making sure the two seals (6.1) are seated properly. Double-acting springless rotary actuators require the use of a reversing amplifier on the connection side of the positioner housing (refer to section 4.6).
7. For actuators with a volume of less than 300 cm³, fit the restriction (order no. 1400-6964) into the signal pressure output of the positioner (or the output of the pressure gauge bracket or connecting plate).
8. Place positioner on housing (10) and screw it tight. Taking the actuator's direction of rotation into account, adjust lever (1) so that it engages in the correct slot with its follower pin (Fig. 13).

4.6 Reversing amplifier for double-acting actuators

For the use with double-acting actuators, the positioner must be fitted with a reversing amplifier, e.g. the SAMSON Type 3710 Reversing Amplifier (see Mounting and Operating Instructions ▶ EB 8392 EN).

If a different reversing amplifier (item no. 1079-1118 or 1079-1119) is used, follow the mounting instructions described in section 4.6.1.

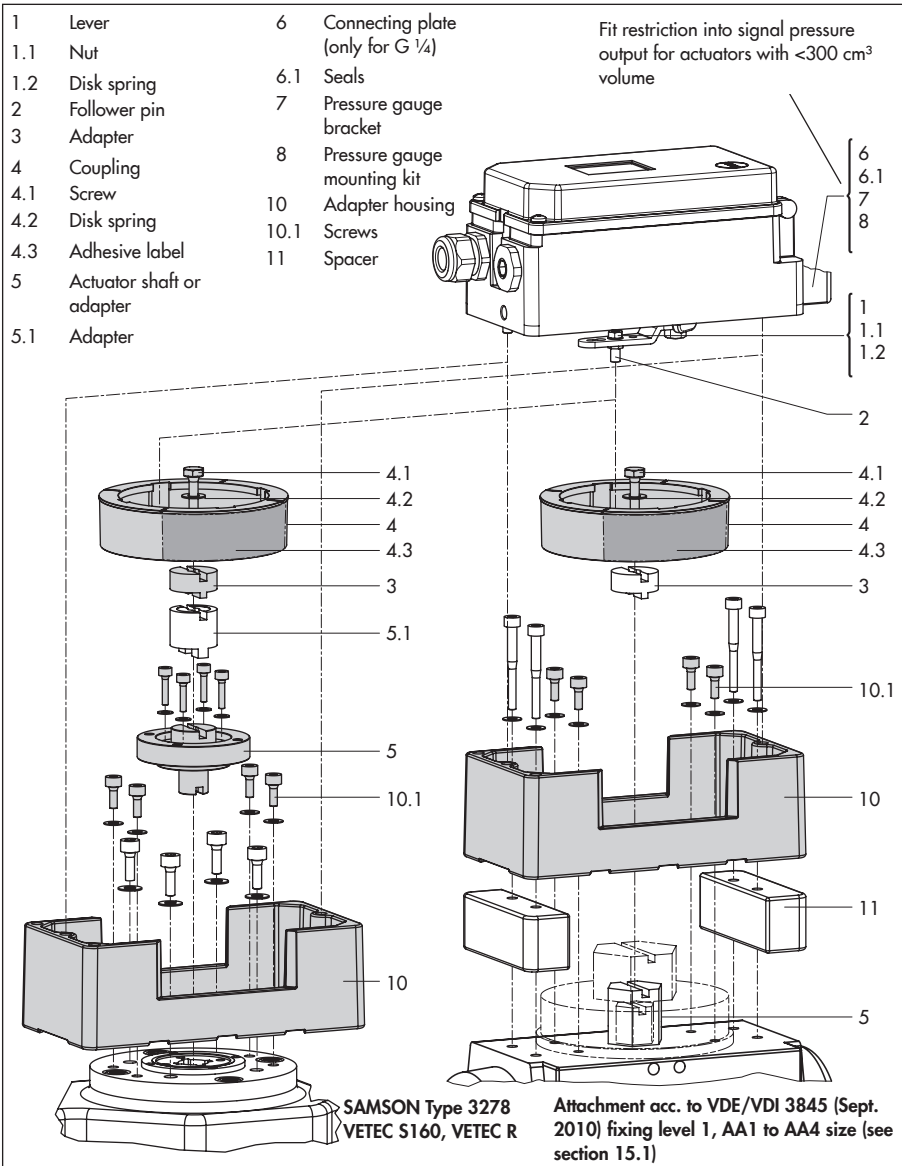

1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Adapter
4 Coupling
4.1 Screw
4.2 Disk spring
4.3 Adhesive label
5 Actuator shaft or adapter
5.1 Adapter
6 Connecting plate (only for G ¼)
6.1 Seals
7 Pressure gauge bracket
8 Pressure gauge mounting kit
10 Adapter housing
10.1 Screws
11 Spacer
Fit restriction into signal pressure output for actuators with <300 cm³ volume
SAMSON Type 3278
VETEC S160, VETEC R
Attachment acc. to VDE/VDI 3845 (Sept. 2010) fixing level 1, AA1 to AA4 size (see section 15.1)

Fig. 12: *Attachment to rotary actuators (heavy-duty version)*

The following applies to all reversing amplifiers:

The signal pressure of the positioner is supplied at the output 1 of the reversing amplifier. An opposing pressure, which equals the required supply pressure (Z) when added to the pressure at output 1, is applied at output 2.
The following relationship applies:
Output 1 + output 2 = Supply pressure (Z).

Connect output 1 to the loading pressure connection on the actuator that causes the valve to open when the pressure rises.

Connect output 2 to the loading pressure connection on the actuator that causes the valve to close when the pressure rises.

➔ Set slide switch on positioner to AIR TO OPEN.

Note:
How the outputs are marked depends on the reversing amplifier used:
*– **Type 3710:** Output 1/2 = Y_1/Y_2*
*– **1079-1118 and 1079-1119:** Output 1/2 = A_1/A_2*

4.6.1 Reversing amplifier (1079-1118 or 1079-1119)

Fig. 14

1. Mount the connecting plate (6) from the accessories in Table 5 to the positioner. Make sure that both O-rings (6.1) are seated correctly.
2. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the boreholes of the connecting plate.
3. Insert the gasket (1.2) into the recess of the reversing amplifier and slide both the hollowed special screws (1.1) into the connecting boreholes **A_1** and **Z**.
4. Place the reversing amplifier onto the connecting plate (6) and screw tight using both the special screws (1.1).
5. Use a screwdriver (8 mm wide) to screw the enclosed filters (1.6) into the connection boreholes **A_1** and **Z**.

NOTICE
Air can escape uncontrolled from the signal pressure connection.
Do not unscrew the sealing plug (1.5) out of the reversing amplifier.

Note:
The rubber seal (1.4) is not required and can be removed when the sealing plug is used.

6. After initialization, set Code 16 (Pressure limit) to No.

Pressure gauge attachment

The mounting sequence shown in Fig. 14 remains unchanged. Screw a pressure gauge bracket onto the connections **A_1** and **Z**.

Pressure gauge bracket	G ¼	1400-7106
	¼ NPT	1400-7107

Pressure gauges for supply air Z and output A_1 as listed in Table 1 to Table 7.

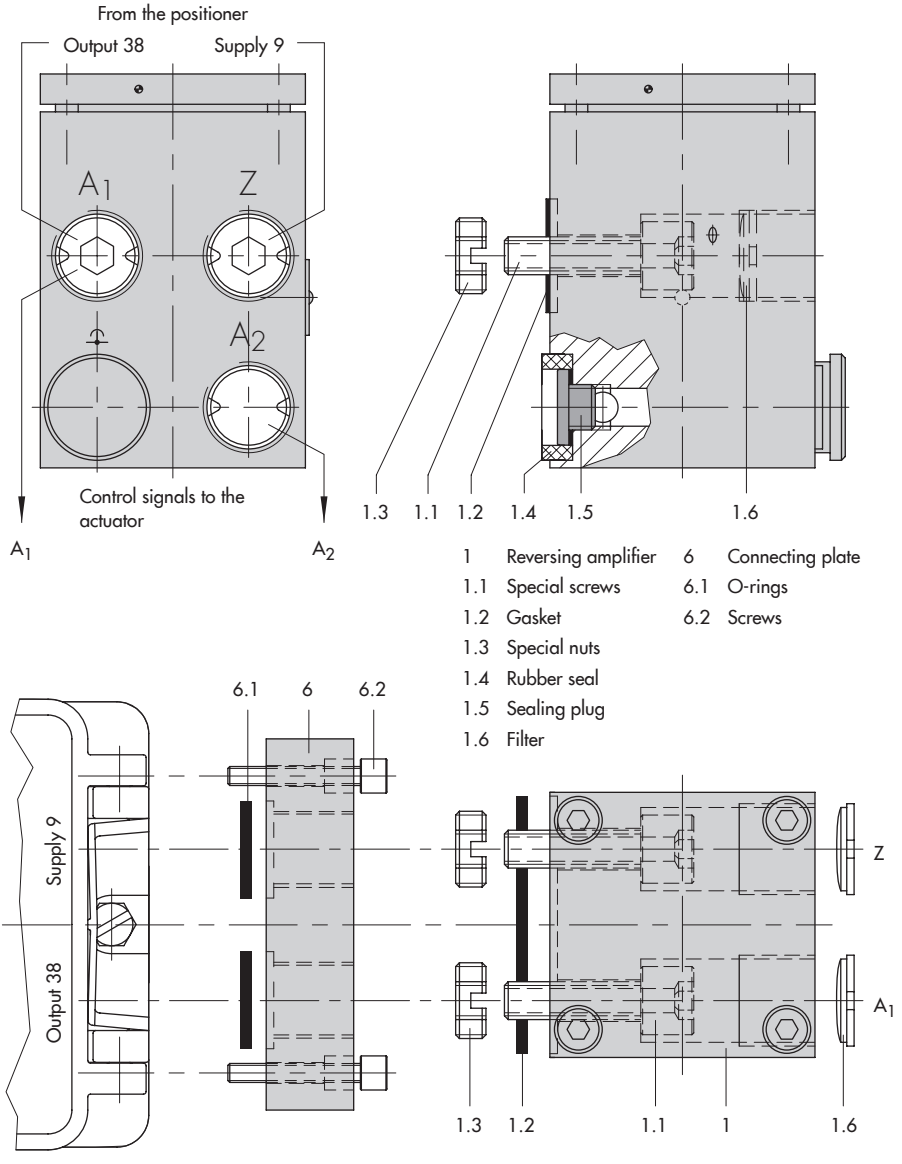


Fig. 14: *Mounting a reversing amplifier (1079-1118 or 1079-1119)*

4.7 Attachment of external position sensor

Positioner unit with sensor mounted on a micro-flow valve

– *Required mounting parts and accessories: Table 7 on page 50*

In the positioner version with an external position sensor, the sensor located in a separate housing is attached over a plate or bracket to the control valve. The travel pick-off corresponds to that of a standard device.
The positioner can be mounted as required to a wall or a pipe.

For the pneumatic connection either a connecting plate (6) or a pressure gauge bracket (7) must be fixed to the housing, depending on the accessory chosen. Make sure the seals (6.1) are correctly inserted (see Fig. 5, bottom right).

For the electrical connection a 10 meter connecting lead with M12x1 connectors is included in the scope of delivery.

Note:
– *In addition, the instructions in sections 5.1 and 5.2 apply for the pneumatic and electrical connection.*

Operation and setting are described in sections 7 and 8.
– *Since 2009, the back of the position sensor (20) is fitted with two pins acting as mechanical stops for the lever (1). If this position sensor is mounted using old mounting parts, two corresponding Ø 8 mm holes must be drilled into the mounting plate/bracket (21). A template is available for this purpose. See Table 7.*

4.7.1 Mounting the position sensor with direct attachment

Type 3277-5 Actuator with 120 cm² (Fig. 15)

The signal pressure from the positioner is routed over the signal pressure connection of the connecting plate (9, Fig. 15 left) to the actuator diaphragm chamber. To proceed, first screw the connecting plate (9) included in the accessories onto the actuator yoke.

– Turn the connecting plate (9) so that the correct symbol for the fail-safe action "actuator stem extends" or "actuator stem retracts" is aligned with the marking (Fig. 15, below).
– Make absolutely sure that the gasket for the connecting plate (9) is correctly inserted.
– The connecting plate has threaded holes with NPT and G threads. Seal the threaded connection that is not used with the rubber seal and square plug.

Type 3277 Actuator with 175 to 750 cm²:

The signal pressure is routed to the connection at the side of the actuator yoke for the version with "actuator stem extends" fail-safe

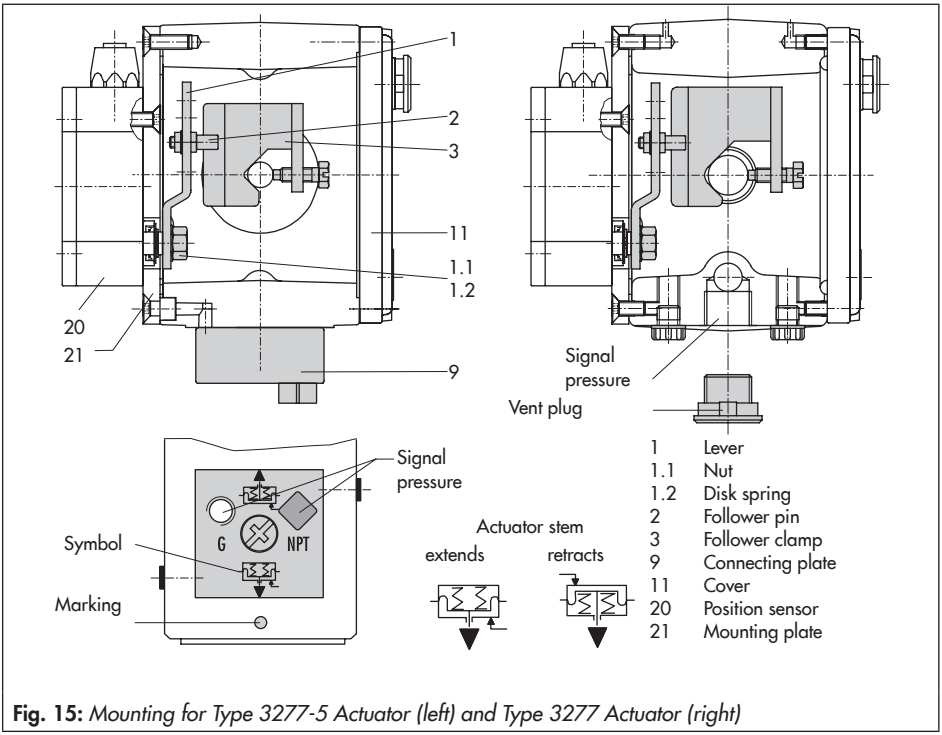


Fig. 15: *Mounting for Type 3277-5 Actuator (left) and Type 3277 Actuator (right)*

action. For the fail-safe action "actuator stem retracts" the connection on the top diaphragm case is used. The connection at the side of the yoke must be fitted with a venting plug (accessories).

Mounting the position sensor

1. Place the lever (1) on the sensor in mid-position and hold it in place. Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).
3. Depending on the actuator size and rated valve travel, determine which lever and position of the follower pin (2) is to be used from the travel table on page 17. The positioner is delivered with the **M** lever in pin position **35** on the sensor. If necessary, remove the follower pin (2) from its pin position and move it to the hole for the recommended pin position and screw tight.
4. Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever in **mid-position** and **hold it in place**. Screw on the nut (1.1).
5. Place follower clamp (3) on the actuator stem, align it and screw tight so that the mounting screw is located in the groove of the actuator stem.
6. Place the mounting plate together with the sensor onto the actuator yoke so that the follower pin (2) rests on the top of the follower clamp (3). It must rest on it with spring force. Fasten the mounting plate (21) onto the actuator yoke using both fixing screws.
7. Mount cover (11) on the other side. Make sure that the vent plug is located at the bottom when the control valve is installed to allow any condensed water that collects to drain off.

4.7.2 Mounting the position sensor with attachment according to IEC 60534-6

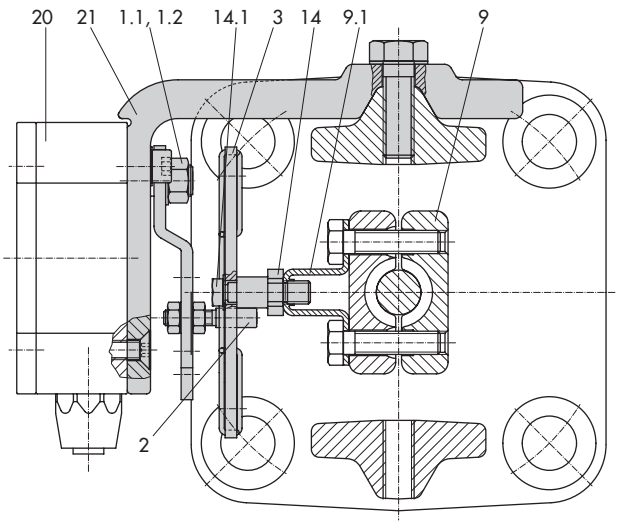
– *Required mounting parts and accessories: Table 7 on page 50*

Fig. 16

1. Place the lever (1) on the position sensor in **mid-position** and **hold it in place**. Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the bracket (21).

The standard attached **M** lever with the follower pin (2) at position **35** is designed for 120 to 350 cm² actuators with 15 mm rated travel. For other actuator sizes or travels, select the lever and pin position from the travel table on page 17. **L** and **XL** levers are included in the mounting kit.

3. Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever in **mid-position** and **hold it in place**. Screw on the nut (1.1).
4. Screw the two bolts (14) to the bracket (9.1) of the stem connector (9), place the follower plate (3) on top and use the screws (14.1) for fastening.
5. Place the bracket with the sensor at the NAMUR rib in such a manner that the follower pin (2) rests in the slot of the follower plate (3), then screw the bracket using its fixing screws onto the valve.



1	Lever
1.1	Nut
1.2	Disk spring
2	Follower pin
3	Follower plate
9	Stem connector
9.1	Bracket
14	Pin
14.1	Screws
20	Position sensor
21	Bracket

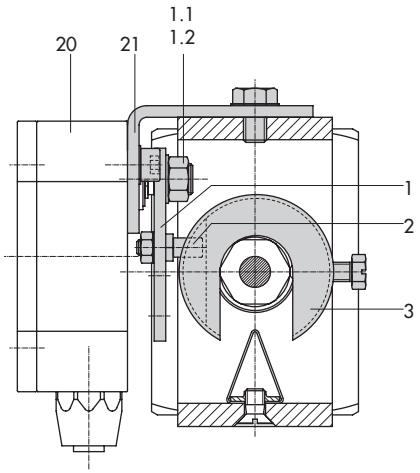
Fig. 16: *Mounting according to IEC 60534-6 (NAMUR)*

4.7.3 Mounting the position sensor to Type 3510 Micro-flow Valve

– *Required mounting parts and accessories: Table 7 on page 50*

Fig. 17

1. Place the lever (1) on the position sensor in **mid-position** and **hold it in place**. Unscrew the nut (1.1) and remove the standard attached **M** lever (1) together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the bracket (21).
3. Select the **S** lever (1) from the accessories and screw the follower pin (2) into the hole for pin position **17**. Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever in mid-position and hold it in place. Screw on the nut (1.1).
4. Place follower clamp (3) on the valve stem connector, align at a right angle and screw tight.
5. Position the bracket (21) with the position sensor on the valve yoke and screw tight, making sure the follower pin (2) slides into the groove of the follower clamp (3).



1	Lever
1.1	Nut
1.2	Disk spring
2	Follower pin
3	Follower clamp
20	Position sensor
21	Bracket

Fig. 17: *Mounting on a micro-flow valve*

4.7.4 Mounting on rotary actuators

– *Required mounting parts and accessories: Table 7 on page 50*

Fig. 18

1. Place the lever (1) on the position sensor in **mid-position** and **hold it in place**. Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).
3. Replace the follower pin (2) normally attached to the lever (1) with the metal follower pin (Ø 5 mm) from the accessories and screw it into the hole for pin position 90°.
4. Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever in **mid-position** and **hold it in place**. Screw on the nut (1.1).

Follow the instructions describing attachment to the standard positioner in section 4.5.

Instead of the positioner, attach the position sensor (20) with its mounting plate (21).

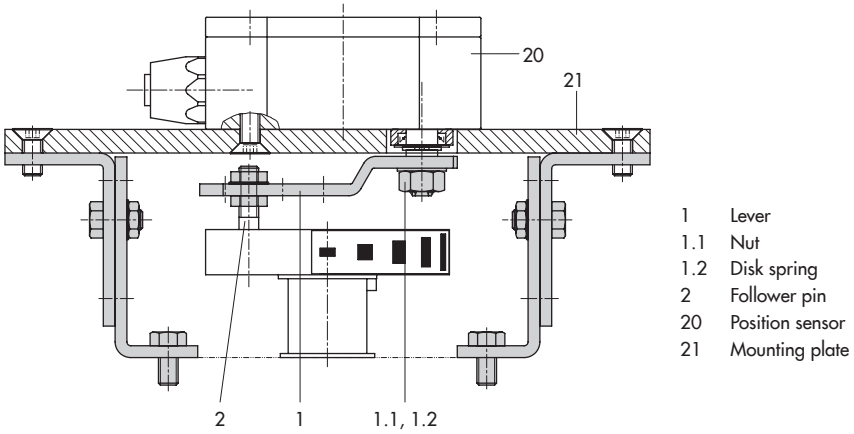


Fig. 18: *Mounting on rotary actuators*

4.8 Mounting the leakage sensor

Fig. 19

Normally, the control valve is delivered with positioner and leakage sensor already mounted.
If the leakage sensor is mounted after the valve has been installed or it is mounted onto another control valve, proceed as described in following.

> ***NOTICE***
> *Risk of malfunction due to incorrect fastening!*
> *Fasten the leakage sensor using a torque of 20 ±5 Nm.*

The M8 threaded connection on the NAMUR rib should preferably be used to mount the sensor (Fig. 19).

> ***Tip:***
> *If the positioner was mounted directly onto the actuator (integral attachment), the NAMUR interfaces on either side of the valve yoke can be used to mount the leakage sensor.*

The start-up of the leakage sensor is described in detail in the Operating Instructions for EXPERTplus Valve Diagnostics
▶ EB 8389 EN.

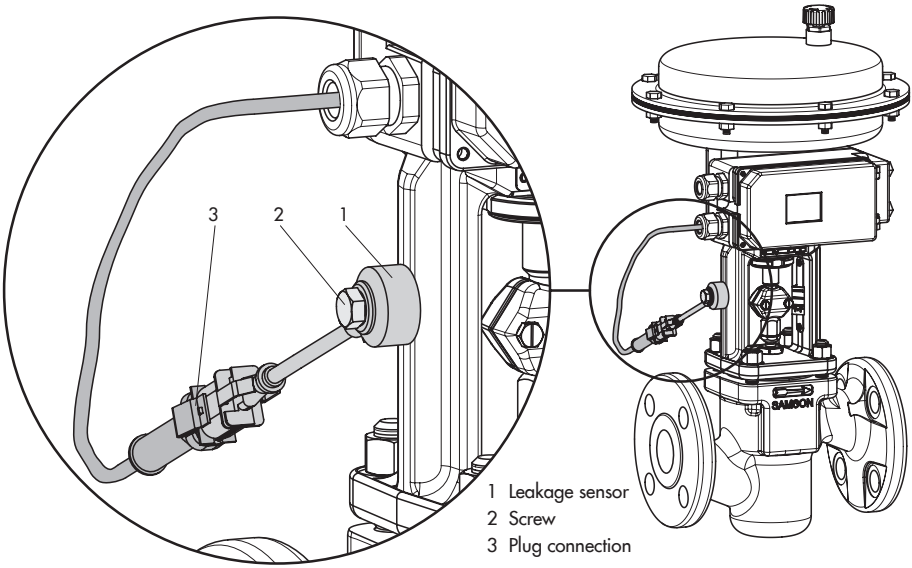


Fig. 19: *Mounting the leakage sensor*

4.9 Attaching positioners with stainless steel housings

Positioners with stainless steel housings require mounting parts that are completely made of stainless steel or free of aluminum.

Note:
The pneumatic connecting plate and pressure gauge bracket are available in stainless steel (order numbers listed below). The Type 3710 Pneumatic Reversing Amplifier is also available in stainless steel.

Connecting plate (stainless steel)	G ¼ ¼ NPT	1400-7476 1400-7477
Pressure gauge bracket (stainless steel)	G ¼ ¼ NPT	1402-0265 1400-7108

Table 1 to Table 6 apply for attaching positioners with stainless steel housings with the following restrictions:

Direct attachment

All mounting kits from Table 1 and Table 2 can be used. The connection block is not required. The stainless steel version of the pneumatic connecting plate routes the air internally to the actuator.

Attachment according to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes)

All mounting kits from Table 3 can be used. Connecting plate in stainless steel.

Attachment to rotary actuators

All mounting kits from Table 5 can be used except for the heavy-duty version. Connecting plate in stainless steel.

4.10 Air purging function for single-acting actuators

The instrument air leaving from the positioner is diverted to the actuator spring chamber to provide corrosion protection inside the actuator. The following must be observed:

Direct attachment to Type 3277-5 (stem extends FA/stem retracts FE)

The air purging function is automatically provided.

Direct attachment to Type 3277, 175 to 750 cm²

FA: Remove the stopper (12.2, Fig. 4) at the black connection block and make a pneumatic connection to the spring chamber on the vented side.

NOTICE
Mounting possibly incorrect when old powder-paint-coated aluminum connection blocks are used.
Mount old powder-paint-coated aluminum connection blocks as described in sections on„Attachment according to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes)“ and „Attachment to rotary actuators“.

FE: The air purging function is automatically provided.

Attachment according to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes) and to rotary actuators

The positioner requires an additional port for the exhaust air that can be connected over piping. An adapter available as an accessory is used for this purpose:

Threaded bushing (M20 x 1.5)	G ¼	0310-2619
	¼ NPT	0310-2550

Note:
The adapter uses one of the M20 x 1.5 connections in the housing which means **only one** *cable gland can be installed.*

Should other valve accessories be used which vent the actuator (e.g. solenoid valve, volume booster, quick exhaust valve), this exhaust air must also be included in the purging function. The connection over the adapter at the positioner must be protected with a check valve (e.g. check valve G ¼, order no. 8502-0597) mounted in the piping. Otherwise the pressure in the positioner housing would rise above the ambient pressure and damage the positioner when the exhausting components respond suddenly.

4.11 Required mounting parts and accessories

Table 1: *Direct attachment to Type 3277-5 Actuator (Fig. 3)*			Order no.
Mounting parts	Standard version for actuators 120 cm² or smaller		1400-7452
	Version compatible with paint for actuators 120 cm² or smaller		1402-0940
Accessories for actuator	Old switchover plate for Type 3277-5xxxxxx.**00** Actuator (old)		1400-6819
	New switchover plate for Type 3277-5xxxxxx.**01** Actuator (new) [1]		1400-6822
	New connecting plate for Type 3277-5xxxxxx.**01** Actuator (new) [1], G ⅛ and ⅛ NPT		1400-6823
	Old connecting plate for Type 3277-5xxxxxx.**00** Actuator (old): G ⅛		1400-6820
	Old connecting plate for Type 3277-5xxxxxx.**00** (old): ⅛ NPT		1400-6821
Accessories for positioner	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/st. steel	1400-6951

[1] Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.

Table 2: *Direct attachment to Type 3277 Actuator (Fig. 4)*					Order no.
Mounting parts	Standard version for actuators 175, 240, 350, 355, 700, 750 cm²				1400-7453
	Version compatible with paint for actuators 175, 240, 350, 355, 700, 750 cm²				1402-0941
Accessories	Piping with screw fittings – for "actuator stem retracts" fail-safe action – with air purging of the top diaphragm chamber	175 cm²	Steel	G ¼/ G ⅜	1402-0970
				¼ NPT/ ⅜ NPT	1402-0976
			St. steel	G ¼ / G ⅜	1402-0971
				¼ NPT/ ⅜ NPT	1402-0978
		240 cm²	Steel	G ¼ / G ⅜	1400-6444
				¼ NPT/ ⅜ NPT	1402-0911
			St. steel	G ¼ / G ⅜	1400-6445
				¼ NPT/ ⅜ NPT	1402-0912
		350 cm²	Steel	G ¼ / G ⅜	1400-6446
				¼ NPT/ ⅜ NPT	1402-0913
			St. steel	G ¼ / G ⅜	1400-6447
				¼ NPT/ ⅜ NPT	1402-0914
		355 cm²	Steel	G ¼ / G ⅜	1402-0972
				¼ NPT/ ⅜ NPT	1402-0979
			St. steel	G ¼ / G ⅜	1402-0973
				¼ NPT/ ⅜ NPT	1402-0980
		700 cm²	Steel	G ¼ / G ⅜	1400-6448
				¼ NPT/ ⅜ NPT	1402-0915
			St. steel	G ¼ / G ⅜	1400-6449
				¼ NPT/ ⅜ NPT	1402-0916
		750 cm²	Steel	G ¼ / G ⅜	1402-0974
				¼ NPT/ ⅜ NPT	1402-0981
			St. steel	G ¼ / G ⅜	1402-0975
				¼ NPT/ ⅜ NPT	1402-0982
	Connection block with seals and screw		G ¼		1400-8819
			¼ NPT		1402-0901
	Pressure gauge mounting kit up to max. 6 bar (output/ supply)		Stainless steel/brass		1400-6950
			St. steel/st. steel		1400-6951

Table 3: *Attachment to NAMUR ribs or control valves with rod-type yokes (20 to 35 mm rod diameter) according to IEC 60534-6 (Fig. 5 and Fig. 9)*

Travel in mm	Lever	For actuator		Order no.
7.5	S	Type 3271-5 with 60/120 cm² on Type 3510 Micro-flow Valve (Fig. 9)		1402-0478
5 to 50	M [1]	Actuators from other manufacturers and Type 3271 with 120 to 750 cm² effective areas		1400-7454
14 to 100	L	Actuators from other manufacturers and Type 3271 with 1000 and 1400-60 cm²		1400-7455
40 to 200	XL	Actuators from other manufacturers and Type 3271 with 1400-120 and 2800 cm² and with 120 mm travel		1400-7456
30 or 60	L	Type 3271 with 1400-120 and 2800 cm² with 30/60 mm travel		1400-7466
		Mounting brackets for Emerson and Masoneilan linear actuators (in addition, a mounting kit according to IEC 60534-6 is required depending on the travel). See rows above.		1400-6771
		Valtek Type 25/50		1400-9554
Accessories	Connecting plate (6)		G ¼	1400-7461
			¼ NPT	1400-7462
	Pressure gauge bracket (7)		G ¼	1400-7458
			¼ NPT	1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)		Stainless steel/brass	1400-6950
			St. steel/st. steel	1400-6951

[1] M lever is mounted on basic device (included in the scope of delivery)

Table 4: *Attachment according to VDI/VDE 3847 (Fig. 6 and Fig. 8)* Electropneumatic positioners with VDI/VDE 3847 interface (Type 3730-5xxx0xxxx0x0070xx)		Order no.
Mounting parts	Interface adapter	1402-0257
	Mounting kit for attachment to SAMSON Type 3277 Actuator	1402-0868
	Mounting kit for attachment to SAMSON Type 3271 Actuator or non-SAMSON actuators	1402-0869
	Travel pick-off for valve travel up to 100 mm	1402-0177
	Travel pick-off for 100 to 200 mm valve travel (SAMSON Type 3271 Actuator only)	1402-0178

Table 5: *Attachment to rotary actuators (Fig. 10 and Fig. 11)*			Order no.
Mounting parts	Attachment acc. to VDI/VDE 3845 (September 2010), see section 15.1 for details Actuator surface corresponds to fixing level 1		
	Size AA1 to AA4, version with CrNiMo steel bracket		1400-7448
	Size AA1 to AA4, heavy-duty version		1400-9244
	Size AA5, heavy-duty version (e.g. Air Torque 10 000)		1400-9542
	Bracket surface corresponds to fixing level 2, heavy-duty version		1400-9526
	Attachment for rotary actuators with max. 180° opening angle, fixing level 2		1400-8815 and 1400-9873
	Attachment to SAMSON Type 3278 with 160/320 cm², CrNiMo steel bracket		1400-7614
	Attachment to SAMSON Type 3278 with 160 cm² and to VETEC Type S160, Type R and Type M, heavy-duty version		1400-9245
	Attachment to SAMSON Type 3278 with 320 cm² and to VETEC Type S320, heavy-duty version		1400-5891 and 1400-9526
	Attachment to Camflex II		1400-9120
Accessories	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/brass	1400-6951

Table 6: *General accessories*			Order no.
Reversing amplifier for double-acting actuators			Type 3710
Cable gland M20 x 1.5,	Black plastic (6 to 12 mm clamping range)		8808-1011
	Blue plastic (6 to 12 mm clamping range)		8808-1012
	Nickel-plated brass (6 to 12 mm clamping range)		1890-4875
	Nickel-plated brass (10 to 14 mm clamping range)		1922-8395
	Stainless steel 1.4305 (8 to 14.5 mm clamping range)		8808-0160
Adapter M20x1.5 to ½ NPT	Powder-coated aluminum		0310-2149
	Stainless steel		1400-4114
Retrofit kit for inductive limit switch 1 x SJ2-SN			1400-7460
Cover plate with list of parameters and operating instructions		DE/EN (delivered state)	1990-0761
		EN/ES	1990-3100
		EN/FR	1990-3142
TROVIS-VIEW 6661 with device module Type 3730-5			

Table 6: *General accessories*	Order no.
Serial interface adapter (SAMSON SSP interface to RS-232 port on a PC)	1400-7700
Isolated USB interface adapter (SAMSON SSP interface to USB port on a PC) including TROVIS-VIEW CD-ROM	1400-9740

Table 7: *Attachment of external position sensor*			Order no.
Template for mounting position sensor on older mounting parts. See note on page 38			1060-0784
Direct attachment	Mounting parts for actuators with 120 cm². See Fig. 15 (left).		1400-7472
	Connecting plate (9, old) with Type 3277-5xxxxxx.**00** Actuator	G ⅛	1400-6820
		⅛ NPT	1400-6821
	Connecting plate (new) with Type 3277-5xxxxxx.**01** Actuator (new) [1]		1400-6823
	Mounting parts for actuators with 175, 240, 350, 355 and 700 cm². See Fig. 15 (right).		1400-7471
NAMUR attachment	Mounting parts for attachment to NAMUR rib using L or XL lever. See Fig. 16.		1400-7468
Attachment to Type 3510 Microflow Valve	Mounting parts for Type 3271 Actuator with 60 cm². See Fig. 17.		1400-7469
Attachment to rotary actuators	VDI/VDE 3845 (September 2010), see section 15.1 for details.		
	Actuator surface corresponds to fixing level 1		
	Size AA1 to AA4 with follower clamp and coupling wheel, version with CrNiMo steel bracket. See Fig. 18.		1400-7473
	Size AA1 to AA4, heavy-duty version		1400-9384
	Size AA5, heavy-duty version (e.g. Air Torque 10 000)		1400-9992
	Bracket surface corresponds to fixing level 2, heavy-duty version		1400-9974
	SAMSON Type 3278 with 160 cm² and VETEC Type S160 and Type R, heavy-duty version		1400-9385
	SAMSON Type 3278 with 320 cm² and VETEC Type S320, heavy-duty version		1400-5891 and 1400-9974
Accessories for positioner	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)	Stainless steel/brass	1400-6950
		Stainless steel/stainless steel	1400-6951
	Bracket to mount the positioner on a wall (**Note:** The other fastening parts are to be provided at the site of installation as wall foundations vary from site to site).		0309-0111

[1] Only new connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.

5 Connections

WARNING!
Risk of injury due to the actuator stem extending or retracting.
Do not touch or block the actuator stem.

NOTICE
Risk of malfunction due to incorrect sequence of mounting, installation and start-up.
Keep the following sequence.

1. *Remove the protective film from the pneumatic connections.*
2. *Mount the positioner on the control valve.*
3. *Connect the supply air.*
4. *Connect the electrical power.*
5. *Perform the start-up settings.*

5.1 Pneumatic connections

NOTICE
Risk of malfunction due to incorrect connection of the supply air.
Do not connect the compressed air directly to the threaded connections in the positioner housing. Screw the screw fittings into the connecting plate, pressure gauge mounting block or connection block from the accessories.

The pneumatic connections in the connecting plate, pressure gauge mounting block and connection block are optionally designed as a bore with ¼ NPT or G ¼ thread. Customary fittings for metal or copper tubing or plastic hoses can be used.

NOTICE
Risk of malfunction due to failure to comply with required air quality.
Only use supply air that is dry and free of oil and dust.
Read the maintenance instructions for upstream pressure reducing stations.
Blow through all air pipes and hoses thoroughly before connecting them.

If the positioner is attached directly to the Type 3277 Actuator, the connection of the positioner's output pressure to the actuator is fixed. For attachment according to IEC 60534-6 (NAMUR), the signal pressure can be routed to either the top or bottom diaphragm chamber of the actuator, depending on the actuator's fail-safe action "actuator stem extends" or "actuator stem retracts".

For rotary actuators, the manufacturer's specifications for connection apply.

5.1.1 Signal pressure gauges

To monitor the supply air (supply) and signal pressure (output), we recommend mounting pressure gauges (see accessories in Table 1to Table 6).

5.1.2 Supply pressure

The required supply air pressure depends on the bench range and the actuator's operating direction (fail-safe action).

The bench range is written on the nameplate either as the spring range or signal pressure range depending on the actuator. The direction of action is marked FA or FE, or by a symbol.

Actuator stem extends FA (AIR TO OPEN)

Fail-close (for globe and angle valves):

Required supply pressure = Upper bench range value + 0.2 bar, at least 1.4 bar.

Actuator stem retracts FE (AIR TO CLOSE)

Fail-open (for globe and angle valves):

For tight-closing valves, the maximum signal pressure pstmax is roughly estimated as follows:

$$pst_{max} = F + \frac{d^2 \cdot \pi \cdot \Delta p}{4 \cdot A} \quad [bar]$$

d = Seat diameter [cm]

Δp = Differential pressure across the valve [bar]

A = Actuator diaphragm area [cm²]

F = Upper bench range value of the actuator [bar]

If there are no specifications, calculate as follows:

Required supply pressure = Upper bench range value + 1 bar

5.1.3 Signal pressure (output)

The signal pressure at the output (38) of the positioner can be restricted to 1.4 bar, 2.4 bar or 3.7 bar in Code 16.
The limitation is not activated [No] by default.

5.2 Electrical connections

DANGER!
Risk of electric shock and/or the formation of an explosive atmosphere.
For electrical installation, observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use. In Germany, these are the VDE regulations and the accident prevention regulations of the employers' liability insurance.
The following regulations apply to installation in hazardous areas:
EN 60079-14: 2008 (VDE 0165, Part 1) **Explosive Atmospheres – Electrical Installations Design, Selection and Erection.**

WARNING!
Incorrect electrical connection will render the explosion protection unsafe.
Adhere to the terminal assignment.
Do not undo the enameled screws in or on the housing.
Do not exceed the maximum permissible values specified in the EC type examination certificates when interconnecting intrinsically safe electrical equipment (U_i or U_0, I_i or I_0, P_i or P_0, C_i or C_0 and L_i or L_0).

Selecting cables and wires

Observe **clause 12 of EN 60079-14: 2008** (VDE 0165, Part 1) for installation of the intrinsically safe circuits.

Clause 12.2.2.7 applies when running multicore cables and wires with more than one intrinsically safe circuit.

The radial thickness of the insulation of a conductor for common insulating materials (e.g. polyethylene) must not be smaller than 0.2 mm. The diameter of an individual wire in a fine-stranded conductor must not be smaller than 0.1 mm. Protect the conductor ends against splicing, e.g. by using wire-end ferrules. When two separate cables or wires are used for connection, an additional cable gland can be installed. Seal cable entries left unused with plugs. Fit equipment used in ambient temperatures **below –20 °C** with metal cable entries.

Equipment for use in zone 2/zone 22

In equipment operated according to type of protection Ex nA II (non-sparking equipment) according to EN 60079-15: 2003, circuits may be connected, interrupted or switched while energized only during installation, maintenance or repair.
Equipment connected to energy-limited circuits with type of protection Ex nL (energy-limited equipment) according to EN 60079-15: 2003 may be switched under normal operating conditions.
The maximum permissible values specified in the statement of conformity and its addenda apply when interconnecting the equipment with energy-limited circuits in type of protection Ex nL IIC.

Cable entry

Cable entry with M20 x 1.5 cable gland. See section on Accessories for clamping range.

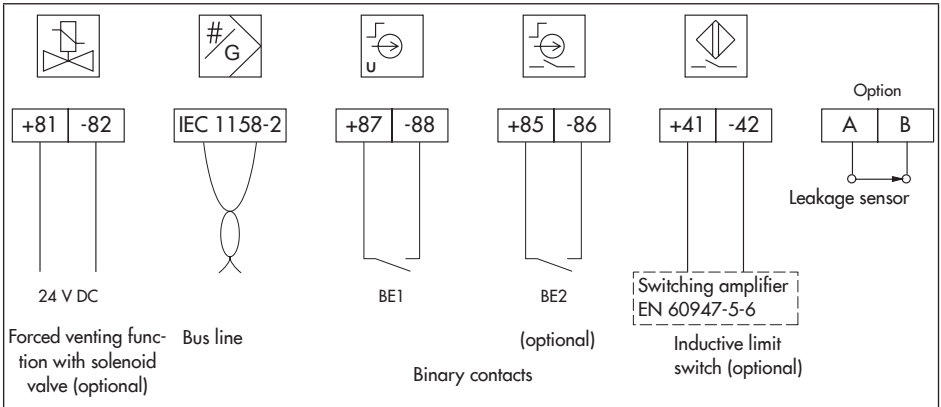


Fig. 20: *Electrical connections*

There is a second M20 x 1.5 threaded hole in the housing that can be used for additional connection, when required.
The screw terminals are designed for wire cross-sections of 0.2 to 2.5 mm². Tighten by at least 0.5 Nm.

Note:
The power supply for the positioner can be supplied either over the connection to the fieldbus segment or over a DC voltage source (9 to 32 V) connected to the bus terminals in the positioner.
Observe the relevant regulations for installation in hazardous areas.

Accessories

Cable glands M20 x 1.5	Order no.
Black plastic (6 to 12 mm clamping range)	8808-1011
Blue plastic (6 to 12 mm clamping range)	8808-1012
Nickel-plated brass (6 to 12 mm clamping range)	1890-4875
Nickel-plated brass (10 to 14 mm clamping range)	1922-8395
Stainless steel 1.4305 (8 to 14.5 mm clamping range)	8808-0160
EMC cable gland M20 x 1.5:	
Nickel-plated brass (7 to 12 mm clamping range)	8808-0143
Adapter M20x1.5 to ½ NPT	
Powder-coated aluminum	0310-2149
Stainless steel	1400-7114

Bus line

Route the two-wire bus line to the screw terminals marked "IEC 1158-2", whereby no polarity needs to be observed.
To connect the limit switch, binary inputs, and forced venting, an additional cable gland that needs to be fitted in place of the existing blanking plug is necessary.

NOTICE
Degree of protection may be impaired.
Do not use the positioner with open cable glands.
Seal cable glands left unused with blanking plugs.

Limit switch

The operation of the limit switch requires a switching amplifier to be connected in the output circuit. Its function is to control the limit values of the control circuit according to EN 60947-5-6, thus ensuring operational reliability of the positioner.
Observe the relevant regulations for installation in hazardous areas.

Binary input BI1

An active contact can be operated at binary input 1. The positioner can report the switching state over the bus protocol.

Binary input BI2

A passive, floating contact can be operated at binary input 2. The positioner can report the switching state over the bus protocol.

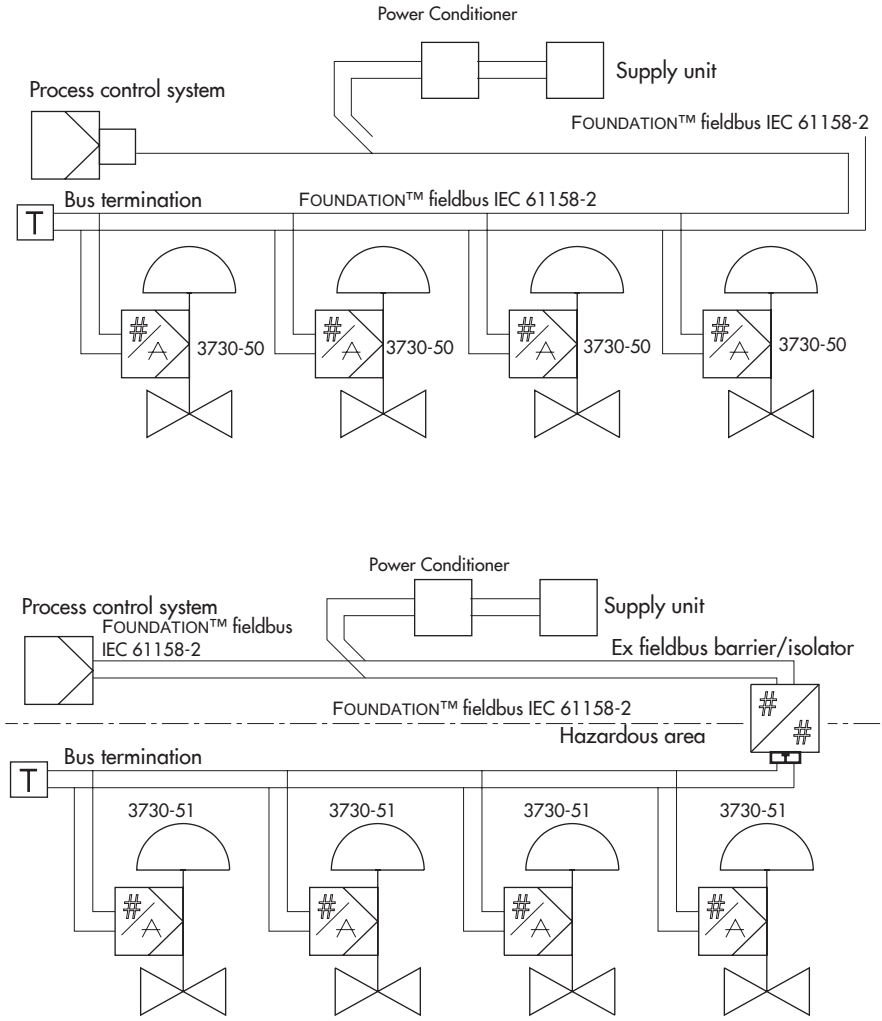


Fig. 21: *Connection acc. to* FOUNDATION™ *fieldbus, for safe areas (top) and for hazardous areas (bottom)*

Solenoid valve (forced venting function)

For positioners fitted with the optional solenoid valve for the forced venting function, a voltage of 24 V DC must be connected to the relevant terminals +81 and –82.
If there is no voltage connected for the solenoid valve at terminals +81 and –82 or when the voltage signal is interrupted, the positioner vents the actuator.

NOTICE
The actuator does not respond to the set point when the voltage is too low. Observe the switching thresholds specified in the technical data.

5.2.1 Establishing communication

The communication structure between the controller, logic solvers (PLC) or automation system, or between a PC or work station and the positioner(s) is implemented to conform with IEC 61158-2.

Note:
The action of the positioner upon failure of the FOUNDATION™ fieldbus communication can be determined over the bus parameters or over the SAMSON TROVIS-VIEW software:
- *The valve remains in its last position.*
- *The valve moves to the fail-safe position.*
- *The valve moves to a defined fault state value.*

Bus parameters: ▶ *KH 8384-5 EN*
- *FEATURES_SEL (RES) > FAULTSTATE*
- *XD_FSTATE_OPT (AO TRD): Action on fault detection*
- *XD_FSTATE_VAL (AO FB): Fault state value*

TROVIS-VIEW:
The parameters can be found in the folder [Settings > Positioner (AO, TRD) > Fail-safe action].

The action selected only takes effect if the positioner is powered. Should a power failure occur at the same time, the actuator is vented and the valve moves to the fail-safe position.

6 Operating controls and readings

Rotary pushbutton

The rotary pushbutton is located underneath the front protective cover. The positioner is operated on site using the rotary pushbutton:

Turn : Select codes and values

Press : Confirm setting

AIR TO OPEN/AIR TO CLOSE slide switch

– AIR TO OPEN applies to a valve opening as the signal pressure increases.
– AIR TO CLOSE applies to a valve closing as the signal pressure increases.

The signal pressure is the pneumatic pressure at the output of the positioner applied to the actuator.

AIR TO OPEN always applies to positioners with a mounted reversing amplifier for double-acting rotary actuators (connections according to section 4.6).

Volume restriction Q

The volume restriction serves to adapt the air output capacity to the size of the actuator. Depending on the air passage at the actuator, two fixed settings are available.

– For actuators smaller than 240 cm² and with a loading pressure connection at the side (Type 3271-5), set restriction to MIN SIDE.
– For a connection at the back (Type 3277-5), set restriction to MIN BACK.
– For actuators 240 cm² and larger, set to MAX SIDE for a side connection and to MAX BACK for a connection at the back.

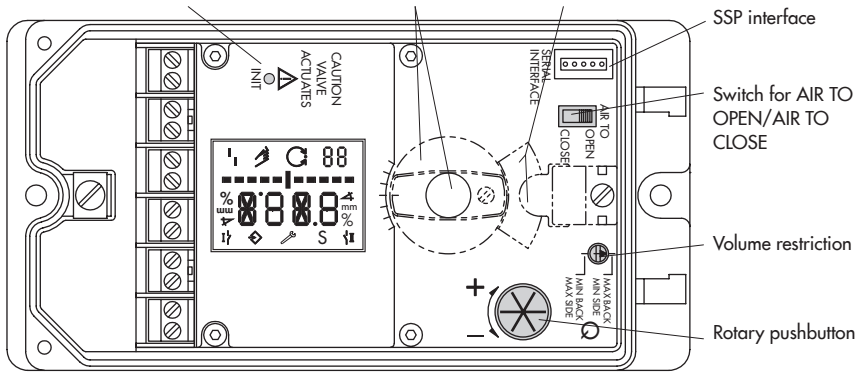


Fig. 22: *Operating elements*

Readings

Icons assigned to certain codes, parameters and functions are indicated on the display.

Operating modes:

– Manual mode (see section 8.2.1)
The positioner follows the manual set point (Code 1) instead of the set point of the Analog Output Block.

Manual mode blinks: The positioner is not initialized. Operation only possible over manual set point (Code 1).

– Automatic mode (see section 8.2.1)
The positioner is in closed-loop operation and follows the set point of the Analog Output Block.

– ***S* SAFE** (see section 8.2.2)
The positioner vents the output. The valve moves to the mechanical fail-safe position.

Bar graph:

In manual and automatic modes, the bars indicate the set point deviation that depends on the sign (+/–) and the value. One bar element appears per 1 % set point deviation.

If the positioner has not been initialized, (manual mode blinks on the display), the bar graph indicates the lever position in degrees in relation to the mid-axis. One bar element corresponds to approximately a 5° angle of rotation. The fifth bar element blinks (reading >30°) if the permissible angle of rotation has been exceeded. Lever and pin position must be checked.

Status messages

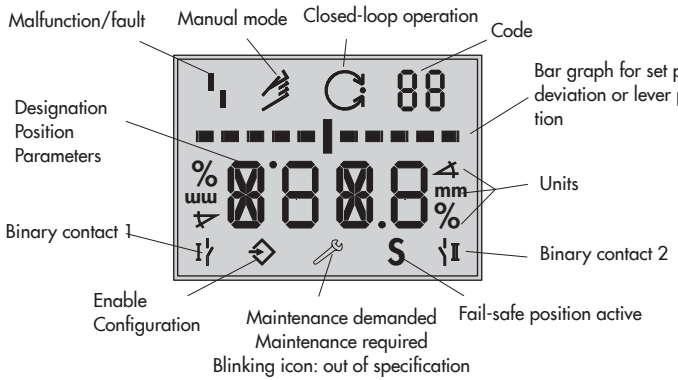
– Maintenance alarm
– Maintenance demanded/ Maintenance required
– blinks: Out of specification

These icons indicate that an error has occurred.

A classified status can be assigned to each error. Classifications include “No message”, “Maintenance required”, “Maintenance demanded” and “Maintenance alarm” (see section 8.3).

Enable configuration

This indicates that the codes marked with an asterisk (*) in the code list (section 14) are enabled for configuration (see section 8.1).



AUtO	Automatic
CL	Clockwise
CCL	Counterclockwise
Err	Error
ESC	Cancel
LOW	w too low
MAN	Manual setting
MAX	Maximum range
No	Not available/not active
NOM	Rated travel
RES	Reset
RUN	Start
SAFE	Fail-safe position
SUb	Substitute calibration
TunE	Initialization in progress
YES	Available/active
ZP	Zero calibration
tEStinG	Test function active
↗↗	Increasing/increasing
↗↘	Increasing/decreasing

blinking: positioner not initialized

S blinking: Valve in mechanical fail-safe position (see SET_FAIL_SAFE_POS parameter in the AO Transducer Block (AO TRD)
▶ KH 8384-5 EN

and together: AO Transducer Block is in the MAN mode ▶ KH 8384-5 EN

and **S** both blinking: The positioner is manual mode while the mechanical fail-safe position (SET_FAIL_SAFE_POS) has been demanded over the fieldbus. After exiting the manual position, the valve moves to the fail-safe position.

blinking: emergency mode (see error code 62 on page 92)

Fig. 23: *Display*

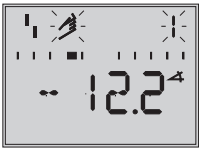
7 Start-up and settings

NOTICE
Risk of malfunction due to incorrect sequence of mounting, installation and start-up.
Keep the following sequence.

1. *Remove the protective film from the pneumatic connections.*
2. *Mount the positioner on the control valve.*
3. *Connect the supply air.*
4. *Connect the electrical power.*
5. *Perform the start-up settings.*

Reading after connecting the electrical power supply:

tEStinG runs across the display and then the fault alarm icon appears and blinks on the display when the **positioner has not been initialized**. The reading indicates the lever position in degrees in relation to the mid-axis.



Reading when the positioner has not yet been initialized

Code 0 appears on the display when a **positioner has been initialized**. The positioner is in the last active operating mode.

WARNING!
Risk of injury due to the actuator stem extending or retracting.
Do not touch or block the actuator stem.

Note:
The positioner performs a test in the start-up phase while following its automation task at the same time. During the start-up phase, operation on site is unrestricted, yet write access is limited.

Perform the start-up settings in the same sequence as described (section 7.1 to section 7.6).

7.1 Defining the valve closed position

Define the closed position of the valve (0 %) taking the valve type and the actuator's direction of action into account. Position the AIR TO OPEN/AIR TO CLOSE slide switch accordingly:

– **AIR TO OPEN** setting
  Signal pressure opens the valve e.g. for a fail-close valve

  The AIR TO OPEN (***AtO***) setting always applies to double-acting actuators.

– **AIR TO CLOSE** setting
  Signal pressure closes the valve e.g. for a fail-open valve

For checking purposes: After successfully completing initialization, the positioner display must read 0 % when the valve is closed and 100 % when the valve is open. If this is

not the case, change the slide switch position and re-initialize the positioner.

Note:
The switch position is prompted prior to an initialization. After an initialization has been completed, changing the switch position does not have any effect on the operation of the positioner.

7.2 Adjusting the volume restriction Q

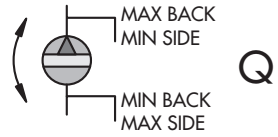


Fig. 24: *Volume restriction Q*
MAX BACK/MIN SIDE setting

The volume restriction Q serves to adapt the air output capacity to the size of the actuator:

– Actuators with a **transit time < 1 s**, e.g. linear actuators with an effective area smaller than 240 cm², require a restricted air flow rate (MIN).
– Actuators with a **transit time ≥ 1 s** do not require the air flow rate to be restricted (MAX).

The position of volume restriction Q also depends on how the signal pressure is routed at the actuator in **SAMSON actuators**:

– The SIDE position applies for actuators with a loading pressure connection at the side, e.g. Type 3271-5.
– The BACK position applies for actuators with a loading pressure connection at the back, e.g. Type 3277-5.
– The SIDE restriction position always applies for actuators from other manufacturers.

Overview · Position of the volume restriction Q*

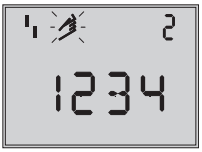
Signal pressure \ Transit time	<1 s	≥1 s
Connection at the side	MIN SIDE	MAX SIDE
Connection at the back	MIN BACK	MAX BACK

* Intermediate settings are not permitted.

NOTICE
Malfunction due to changed start-up settings.
Initialize an initialized positioner again after the position of the volume restriction has been changed.

7.3 Adapting the display direction

To adapt the reading on the display to the mounting situation of the actuator, the display contents can be turned by 180°.



Reading direction for right attachment of pneumatic connections

Reading direction for left attachment of pneumatic connections

If the displayed data appear upside down, proceed as follows:

Turn ⊛ → Code 2

Press ⊛, Code ***2*** blinks.

Turn ⊛ → Required reading direction

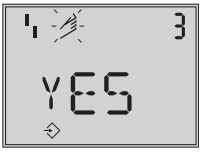
Press ⊛ to confirm reading direction.

7.4 Limiting the signal pressure

If the maximum actuator force may cause damage to the valve, the signal pressure must be limited.

Enable configuration at the positioner before limiting the signal pressure:

Note:
If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.



Enable configuration
Default: ***No***

Turn ⊛ → Code 3, display: ***No***

Press ⊛, Code *3* blinks.

Turn ⊛ → ***YES***

Press ⊛, display: ⇨

Limit the signal pressure:

Pressure limit
Default: ***No***

Turn ⊛ → Code 16

Press ⊛, Code ***16*** blinks.

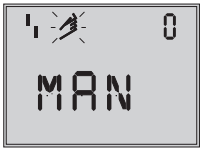
Turn ⊛ until the required pressure limit (1.4/2.4/3.7 bar) appears.

Press ⊛ to confirm the pressure limit setting.

7.5 Checking the operating range of the positioner

To check the mechanical attachment and the proper functioning, the valve should be moved through the operating range of the positioner in the ☞ manual mode with the manual set point.

Select ☞ manual mode:



Operating mode
Default ***MAN***

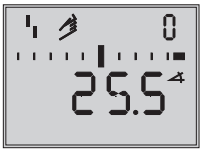
Turn ⊛ → Code 0

Press ⊛, Code *0* blinks.

Turn ⊛ → ***MAN***

Press ⊛. The positioner changes to the manual mode (☞).

Check the operating range:



Manual set point w (current angle of rotation is indicated)

Turn ⊛ → Code 1

Press ⊛, Code *1* and ☞ blink.

Turn ⊛ until the pressure in the positioner builds up, and the control valve moves to its final positions so that the travel/angle can be checked.

The angle of rotation of the lever on the back of the positioner is indicated. A horizontal lever (mid position) is equal to 0°.

To ensure the positioner is working properly, the outer bar elements must not blink while the valve is moving through the operating range.

Exit Code 1 by pressing the rotary pushbutton (⊛).

The permissible range has been exceeded when the displayed angle is more than 30° and the outer right or left bar element blinks. The positioner goes to the fail-safe position (SAFE).

After canceling the fail-safe position (SAFE) (see section 8.2.2) it is **absolutely** essential that you check the lever and pin position as described in section 4.

WARNING!
Risk of injury due to the actuator stem extending or retracting.
Before exchanging the lever or changing the pin position, disconnect the supply air and electrical auxiliary power.

7.6 Initialization

NOTICE
The process is disturbed by the movement of the actuator stem.
Do not initialize the positioner while the process is running; only perform an initialization during start-up with the shut-off valves closed.

A signal pressure above the maximum permissible limit will damage the valve.
Check the maximum permissible signal pressure of the control valve before starting initialization. If necessary, limit the signal pressure by connecting an upstream pressure reducing valve.

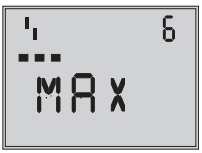
Malfunction due to changed mounting or installation circumstances.
Reset the positioner to its default settings and re-initialize it after the positioner has been mounted on to another actuator or its mounting location has been changed.

During initialization the positioner adapts itself optimally to the friction conditions and

the signal pressure required by the control valve. The type and extent of auto tuning depends on the initialization mode selected:

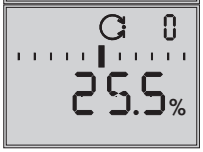
– **Maximum range (MAX)** (standard range)
  Initialization mode for simple start-up of valves with two clearly defined mechanical end positions, e.g. three-way valves (see section 7.6.1)
– **Nominal range (NOM)**
  Initialization mode for all globe valves (see section 7.6.2)
– **Manually selected range (MAN)**
  Initialization mode for globe valves with an unknown nominal range (see section 7.6.3)
– **Substitute calibration (SUb)**
  This mode allows a positioner to be replaced while the plant is running, with the least amount of disruption to the plant (see section 7.6.4).

Note:
For normal operation, simply start initialization by pressing the INIT key after mounting the positioner on the valve and defining the fail-safe position and setting the volume restriction. The positioner only needs to work with its default settings. If necessary, perform a reset (see section 7.8).



Alternating readings
Initialization in progress
Icon depending on initialization mode selected

Bar graph display indicating the progress of the initialization



Initialization successfully completed. Positioner in automatic mode (↻)

The time required for the initialization procedure depends on the actuator transit time and can take a few minutes.
After a successful initialization, the positioner runs in closed-loop operation indicated by the ↻ closed-loop operation icon.
A malfunctioning leads to the process being canceled. The initialization error appears on the display according to how it has been classified by the condensed state. Refer to section 8.3.

Note:
*When Code **48 - h0** = YES, the diagnostics automatically start to plot the reference graphs (drive signal steady-state d1 and hysteresis d2) after initialization has been completed. This is indicated by **tESt** and **d1** or **d2** appearing on the display in alternating sequence.*
*An error during the plotting of the reference graphs is indicated on the display over **Code 48 - h1** and Code **81**.*
The reference graphs do not have any effect on closed-loop operation.

Closed position AIR TO CLOSE

If the slide switch is set to AIR TO CLOSE, the positioner automatically switches to the direction of action increasing/decreasing (↗↘) after initialization has been completed. This results in the following assignment between set point and valve position:

Closed position	Direction of action	Set point Valve CLOSED at	Set point Valve OPEN at
Actuator stem extends (FA) AIR TO OPEN	↗↗	0 %	100 %
Actuator stem retracts (FE) AIR TO CLOSE	↗↘	100 %	0 %

The tight-closing function has been activated.

Set Code 15 (final position w>) to 99 % **for three-way valves.**

Canceling an initialization process

An initialization procedure in progress can be canceled by pressing the rotary pushbutton (⊛). ***STOP*** appears for three seconds on the display and the positioner then changes to the fail-safe position.

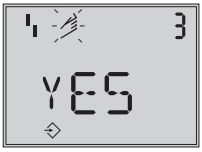
Exit the fail-safe position again over Code 0 (see section 8.2.2).

7.6.1 MAX – Initialization based on maximum range

The positioner determines travel/angle of rotation of the closing member from the CLOSED position to the opposite travel stop and adopts this travel/angle of rotation as the operating range from 0 to 100 %.

Enable configuration:

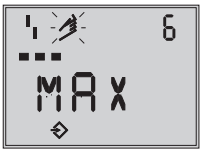
> ***Note:***
> *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Default: ***No***

Turn ⊛ → Code 3, display: ***No***
Press ⊛, Code ***3*** blinks.
Turn ⊛ → ***YES***
Press ⊛, display: ⇨

Select the initialization mode:



Default ***MAX***

Turn ⊛ → Code 6
Press ⊛.
Turn ⊛ → ***MAX***

Press ⊛ to confirm the MAX as the initialization mode.

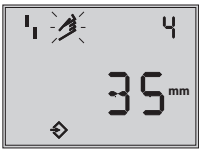
Start initialization:

➔ Press INIT key.

The nominal travel/angle of rotation is indicated in % after initialization. Code 5 (nominal range) remains locked. The parameters for travel/angle range start (Code 8) and travel/angle range end (Code 9) can also only be displayed and modified in %.

For a reading in mm/°, enter the pin position (Code **4**).

Enter the pin position:



Pin position
Default: ***No***

Turn ⊛ → Code 4

Press ⊛, Code ***4*** blinks.

Turn ⊛ → Pin position on lever (see relevant section on attachment)

Press ⊛.

The reading of the nominal range appears in mm/°.

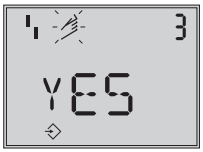
7.6.2 NOM – Initialization based on nominal range

The calibrated sensor allows the effective valve travel to be set very accurately. During initialization, the positioner checks whether the control valve can move through the indicated nominal range (travel or angle) without collision. If this is the case, the indicated nominal range is adopted with the limits of travel/angle range start (Code 8) and travel/angle range end (Code 9) as the operating range.

Note:
The maximum possible travel must always be greater than the nominal travel entered. If this is not the case, initialization is automatically canceled (error message Code 52) because the nominal travel could not be achieved.

Enable configuration:

Note:
If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.



Default: ***No***

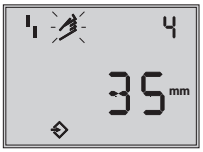
Turn ⊛ → Code 3, display: **No**

Press ⊛, Code ***3*** blinks.

Turn ⊛ → ***YES***

Press ⊛, display: ⇨

Enter the pin position and nominal range:

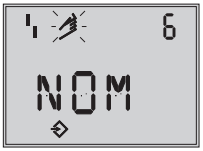


Pin position
Default: ***No***

Nominal range
(locked when Code 4 = No)

Turn ⊛ → Code 4
Press ⊛, Code ***4*** blinks.
Turn ⊛ → Pin position on lever (see relevant section on attachment)
Press ⊛.
Turn ⊛ → Code 5
Press ⊛, Code ***5*** blinks.
Turn ⊛ → Nominal travel of the valve
Press ⊛.

Select the initialization mode:



Init mode
Default ***MAX***

Turn ⊛ → Code 6
Press ⊛, Code ***6*** blinks.
Turn ⊛ → ***NOM***
Press ⊛ to confirm the NOM as the initialization mode.

Start initialization:

➔ Press INIT key.

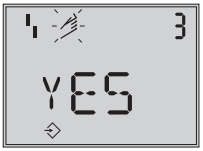
➔ After initialization, check the direction of action (Code 7) and, if necessary, change it.

7.6.3 MAN – Initialization based on a manually selected range

Before starting initialization, move the control valve manually to the OPEN position. Turn the rotary pushbutton (⊛) clockwise in small steps. The valve must be moved with a monotonically increasing signal pressure. The positioner calculates the differential travel/angle from the OPEN and CLOSED positions and adopts it as the operating range with limits of lower travel/angle range value (Code 8) and upper travel/angle range value (Code 9).

Enable configuration:

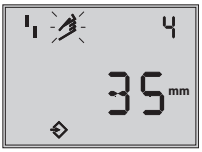
Note:
If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.



Enable configuration
Default: ***No***

Turn ⊛ → Code 3, display: ***No***
Press ⊛, Code ***3*** blinks.
Turn ⊛ → ***YES***
Press ⊛, display: ⇨

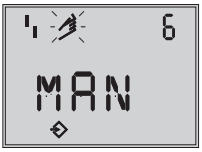
Enter the pin position:



Pin position
Default: ***No***

Turn ⊛ → Code 4
Press ⊛, Code ***4*** blinks.
Turn ⊛ → Pin position on lever (see relevant section on attachment)
Press ⊛.

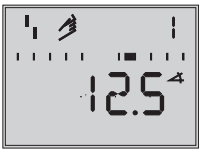
Select the initialization mode:



Init mode
Default ***MAX***

Turn ⊛ → Code 6
Press ⊛, Code ***6*** blinks.
Turn ⊛ → ***MAN***
Press ⊛ to confirm the ***MAN*** as the initialization mode.

Enter OPEN position:



Manual set point
(current angle of rotation is indicated)

Turn ⊛ → Code 0
Press ⊛, Code ***0*** blinks.
Turn ⊛ → ***MAN***
Press ⊛.
Turn ⊛ → Code 1
Press ⊛, Code ***1*** blinks.
Turn ⊛ until the valve reaches its OPEN position.
Press ⊛ to confirm the OPEN position.

Start initialization:

➔ Press INIT key.

7.6.4 SUb – Substitute calibration

A complete initialization procedure takes several minutes and requires the valve to move through its entire travel range several times. This initialization mode, however, is an emergency mode, in which the control parameters are estimated and not determined by an initialization procedure. As a result, a high level of accuracy cannot be expected. You should always select a different initialization mode if the plant allows it.

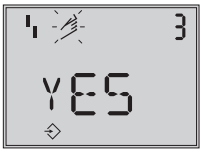
The substitute calibration is used to replace a positioner while the process is running. For this purpose, the control valve is usually fixed mechanically in a certain position, or pneumatically by means of a pressure signal which is routed to the actuator externally. The blocking position ensures that the plant continues to operate with this valve position.

By entering the blocking position (Code 35), closing direction (Code 34), pin position (Code 4), nominal range (Code 5) and direction of action (Code 7), the positioner can calculate the positioner configuration.

NOTICE
Perform a reset before re-initializing the positioner if the substitute positioner has already been initialized. Refer to section 7.8.

Enable configuration:

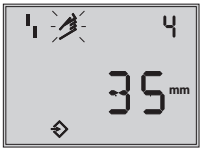
Note:
If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.



Enable configuration
Default: ***No***

Turn → Code 3, display: ***No***
Press, Code ***3*** blinks.
Turn → ***YES***
Press, display:

Enter the pin position and nominal range:

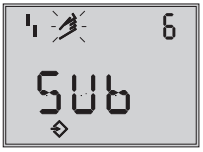


Pin position
Default: ***No***

Nominal range
(locked when Code 4 = No)

Turn → Code 4
Press, Code ***4*** blinks.
Turn → Pin position on lever (see relevant section on attachment)
Press.
Turn → Code 5
Press, Code ***5*** blinks.
Turn → Nominal travel of the valve
Press.

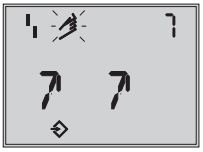
Select the initialization mode:



Init mode
Default ***MAX***

Turn → Code 6
Press.
Turn → ***SUb***
Press to confirm the ***SUb*** as the initialization mode.

Enter the direction of action:



Direction of action
Default ↗↗

Turn → Code 7
Press, Code ***7*** blinks.
Turn → Direction of action (↗↗/↗↘)
Press.

Deactivate travel limit:

Travel limit
Default: ***No***

Turn ⊛ → Code 11

Press ⊛, Code ***11*** blinks.

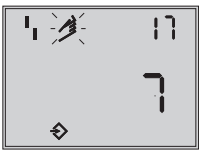
Turn ⊛ → **No**

Press ⊛.

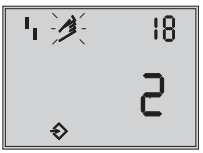
Change pressure limit and control parameters:

Note:
Do not change the pressure limit (Code 16). Only change the control parameters K_P (Code 17) and T_V (Code 18) if the settings of the the replaced positioner are known.

Pressure limit
Default: ***No***



K_P level
Default ***7***



T_V level
Default ***2***

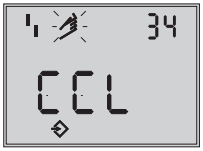
Turn ⊛ → Code 16/17/18

Press ⊛, Code ***16/17/18*** blinks.

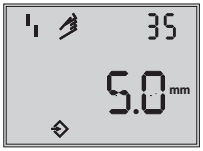
Turn ⊛ to set the control parameter selected.

Press ⊛ to confirm the setting.

Enter closing direction and blocking position:



Closing direction (direction of rotation causing the valve to move to the CLOSED position (view onto positioner display)
Default: CCL (counterclockwise)



Blocking position
Default **0**

Turn ⊛ → Code 34

Press ⊛, Code ***34*** blinks.

Turn ⊛ → Closing direction (CCL = counterclockwise/CL = clockwise)

Press ⊛.

Turn ⊛ → Code 35

Press ⊛, Code ***35*** blinks.

Turn ⊛ → Blocking position, e.g. 5 mm (read off at travel indicator scale of the blocked valve or measure with a ruler).

Set the fail-safe position:

➔ Set switch for closed position AIR TO OPEN or AIR TO CLOSE according to section 7.1.

➔ Set volume restriction as described in section 7.2.

Start initialization:

➔ Press INIT key.

The positioner switches to ***MAN*** mode.
The blocking position is indicated.

Note:
Since initialization has not been completed, the error code 76 (no emergency mode) and possibly also error code 57 (control loop) may appear on the display. These alarms do not influence the positioner's readiness for operation.

Cancel the blocking position and change to automatic mode (AUTO):

For the positioner to follow its set point again, the blocking position must be canceled and the positioner must be set to automatic mode as follows:

Turn ⊛ → Code 1

Press ⊛, Code 1 and ⇗ blink.

Turn ⊛ in order to move the valve slightly past the blocking position.

Press ⊛ to cancel mechanical blocking.

Turn ⊛ → Code 0

Press ⊛, Code ***0*** blinks.

Turn ⊛ → ***AUtO***

Press ⊛.

The positioner switches to automatic mode.
The current valve position is indicated in %.

Note:
If the positioner shows a tendency to oscillate in automatic mode, the parameters K_P and T_V must be slightly corrected. Proceed as follows:
Set T_V (Code 18) to ***4.***
If the positioner still oscillates, the gain K_P (Code 17) must be decreased until the positioner shows a stable behavior.

Zero point calibration

Finally, if process operations allow it, the zero point must be calibrated according to section 7.7.

7.7 Zero calibration

In case of inconsistencies in the closed position of the valve, e.g. with soft-seated plugs, it might be necessary to recalibrate zero.

NOTICE
The process is disturbed by the movement of the actuator stem.
Do not perform zero calibration while the process is running. First isolate the plant by closing the shut-off valves.

Note:
The positioner must be connected to the supply air to perform the zero calibration.

Enable configuration:

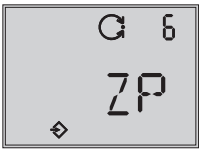
Turn ⊛ → Code 3, display: **No**

Press ⊛, Code ***3*** blinks.

Turn ⊛ → ***YES***

Press ⊛, display: ⇨

Perform zero calibration:



Init mode
Default *MAX*

Turn → Code 6

Press, Code ***6*** blinks.

Turn → ***ZP***

➔ Press INIT key.
Zero calibration starts. The positioner moves the valve to the CLOSED position and recalibrates the internal electrical zero point.

7.8 Reset to default settings

This function resets all start-up parameters as well as the diagnosis to the factory default settings (see code list in section 14).

Enable configuration:

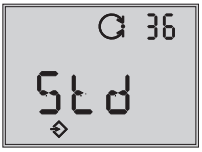
Turn → Code 3, display: ***No***

Press, Code ***3*** blinks.

Turn → ***YES***

Press, display: ⇨

Reset start-up parameters:



Reset
Default: ***No***

Turn → Code 36, display: ••–••–

Press, Code ***36*** blinks.

Turn → ***Std***

Press.
All start-up parameters as well as the diagnosis are reset to their default values.

Note:
Code 36 - diAG allows just the diagnosis data (EXPERTplus) to be reset. Refer to the Operating Instructions for EXPERTplus valve diagnostics
▶ *EB 8389 EN.*

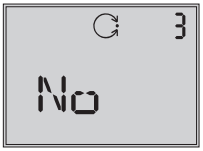
8 Operation

WARNING!
Risk of injury due to the actuator stem extending or retracting.
Do not touch or block the actuator stem.

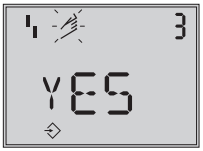
8.1 Enabling and selecting parameters

All codes and their meaning and default settings are listed in the code list in section 14.

Codes which are marked with an asterisk must be enabled with Code 3 before the associated parameters can be configured as described below.



Code 3
Configuration not enabled



Configuration enabled

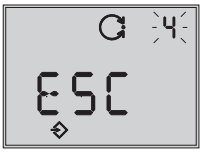
Turn ⊛ → Code 3, display: ***No***
Press ⊛, Code ***3*** blinks.
Change the setting in Code 3.
Turn ⊛ → ***YES***
Press ⊛, display: ⇨
Configuration is enabled.

You can now configure codes one after the other:

Turn ⊛ to select the required code.
Press ⊛ to activate the selected code. The code number starts to blink.
Turn ⊛ to select the setting.
Press ⊛ to confirm the selected setting.

Note:
If no settings are entered within 120 seconds, the enabled configuration function becomes invalid and the display returns to Code 0.

Cancel the setting:



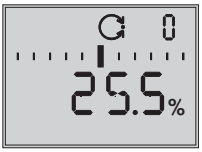
Canceling the reading

To cancel a value before it is confirmed (by pressing ⊛) proceed as follows:
Turn ⊛ → ***ESC***
Press ⊛.
The entered value is not adopted.

8.2 Operating modes

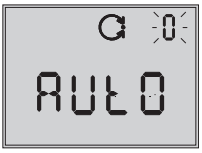
8.2.1 Automatic and manual modes

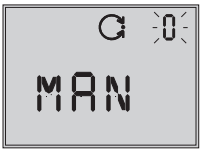
After initialization has been completed successfully, the positioner is in ↻ automatic mode (AUTO).



Automatic mode

Switching to manual mode (MAN)





Turn → Code 0

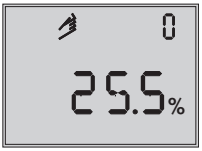
Press, display: ***AUtO***, Code ***0*** blinks.

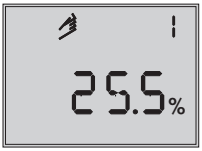
Turn → ***MAN***

Press. The positioner changes to the manual mode ().

The manual mode starts using the last set point of the automatic mode, ensuring a bumpless changeover. The current position is displayed in %.

Adjust the manual set point





Turn → Code 1

Press, Code ***1*** blinks.

Turn until sufficient pressure has been built up in the positioner and the control valve moves to the required position.

Note:
The positioner automatically returns to Code 0 if no settings are made within 120 seconds, but remains in the manual mode.

Switch to automatic mode

Turn → Code 0

Press, Code ***0*** blinks.

Turn → ***AUtO***

Press. The positioner switches to automatic mode.

8.2.2 Fail-safe position (SAFE)

If you want to move the valve to the fail-safe position determined during start-up (see section 7.1), proceed as follows:

Turn → Code 0

Press, display: current operating mode (***AUTO*** or ***MAN***), Code ***0*** blinks.

Turn → ***SAFE***

Press, display: ***S***

The valve moves to the fail-safe position.

If the positioner has been initialized, the current valve position in % is indicated on the display.

Exit the fail-safe position

Turn ⊛ → Code 0

Press ⊛, Code ***0*** blinks.

Turn ⊛ and select the required operating mode (***AUtO*** or ***MAN***).

Press ⊛.

The positioner switches to the operating mode selected.

8.3 Fault/malfunction

A status classification is assigned to all status and fault alarms in the positioner. The default settings of the status classification are listed in the code list.

Note:
The assignment of the status classification can be changed in TROVIS-VIEW and over the FOUNDATION™ fieldbus parameters. Refer to the Operating Instructions on the valve diagnostics ▶ EB 8389 EN and the Configuration Manual ▶ KH 8384-5 EN on the enclosed CD-ROM for more details.

To provide a better overview, the classified messages are summarized in a condensed state for the positioner according to the NAMUR Recommendation NE 107. The status messages are divided into the following categories:

– **Maintenance alarm**
The positioner cannot perform its control task due to a functional fault in the positioner itself or in one of its peripherals or an initialization has not yet been successfully completed.

– **Maintenance required**
The positioner still performs its control task (with restrictions). A maintenance demand or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the medium term.

– **Maintenance demanded**
The positioner still performs its control task (with restrictions). A maintenance demand or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the short term.

– **Out of specification**
The positioner is running outside the specified operating conditions.

– **Function check**
Test or calibration procedures are performed in the positioner. The positioner is temporarily unable to perform its control task as long as the procedure is taking place.

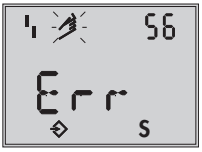
Note:
If an event is classified as "No message", this event does not have any affect on the condensed state.

The condensed state appears on the display represented by the following icons:

Condensed state	Positioner display
Maintenance alarm	
Function check	Text e.g. tESting, ***TunE*** or ***tESt***
Maintenance required/ maintenance demanded	
Out of specification	blinking

If the positioner has not been initialized, the maintenance alarm icon ( ) appears on the display as the positioner cannot follow its set point.

If fault alarms exist, the possible source of error is displayed in Code 49 onwards. In this case, ***Err*** appears on the display.



Example:
Error caused by pin position

Refer to the code list (section 14) for possible causes and the recommended action.

8.3.1 Confirming error messages

Enable configuration:

> ***Note:***
> *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*

Turn → Code 3, display: ***No***
Press , Code ***3*** blinks.

Turn → ***YES***
Press , display:

Confirming error message:

Turn → Select the error code that you want to confirm.
Press .
The error message is confirmed.

9 Adjusting the limit switch

The positioner version with an inductive limit switch has an adjustable tag (1) mounted on the axis of rotation, which operates the proximity switch (3).

For operation of the inductive limit switch, the corresponding switching amplifier (see section 5.2.1) must be connected to the output circuit.

When the tag (1) is located in the inductive field of the switch, the switch assumes a high resistance. When it moves outside the field, the switch assumes a low resistance.

Normally, the limit switch is adjusted in such a way that it will provide a signal in both end positions of the valve. The switch, however, can also be adjusted to indicate intermediate valve positions.

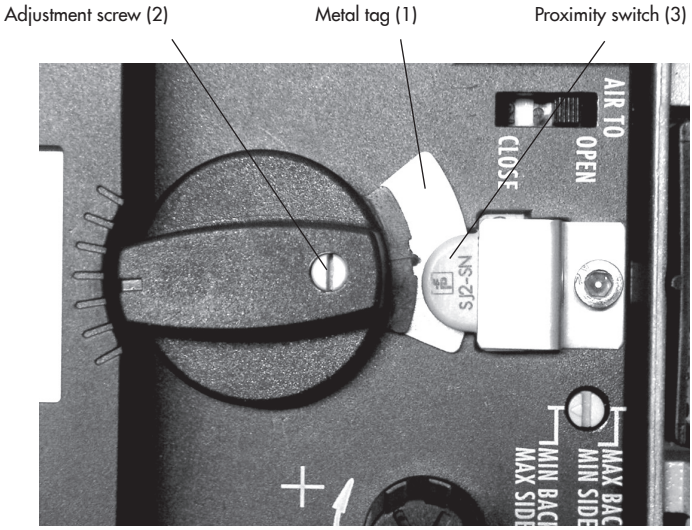


Fig. 25: *Adjusting the limit switch*

The required switching function, i.e. whether the output relay is to be picked up or released when the tag enters the field, must be selected at the switching amplifier, if required.

Adjusting the switching point:

Note:
During adjustment or testing, the switching point must always be approached from mid-position (50 %).

To guarantee the switching under all ambient conditions, adjust the switching point approx. 5 % before the mechanical stop (OPEN – CLOSED).

For CLOSED position:

1. Initialize the positioner.
2. Move the valve to 5 % in the MAN mode (see display).
3. Adjust the tag at the yellow adjustment screw (2) until the tag enters or leaves the field and the switching amplifier responds.
   You can measure the switching voltage as an indicator.

Contact function:

– Tag leaving the field > contact is closed.
– Tag entering the field > contact is opened.

For OPEN position:

1. Initialize the positioner.
2. Move the valve to 95 % in the MAN mode (see display).
3. Adjust the tag (1) at the yellow adjustment screw (2) until the tag enters or leaves the field of the proximity switch (3).
   You can measure the switching voltage as an indicator.

Contact function:

– Tag leaving the field > contact is closed.
– Tag entering the field > contact is opened.

9.1 Retrofitting an inductive limit switch

Required retrofit kit:

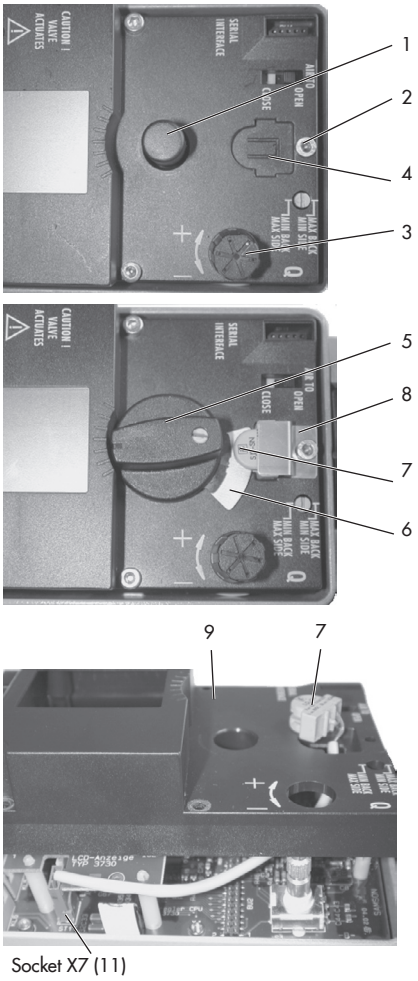
Limit switch Order no. 1400-7460

Note:
The same requirements apply to retrofitting an inductive limit switch as to servicing the positioner. For explosion-protected positioners, the requirements in section 11(Servicing explosion-protected devices) need to be kept. Check the "Limit switch, inductive" box on the nameplate after installing the limit switch.

1. Take off the rotary pushbutton (3) and cap (1), unthread the five fastening screws (2) and lift off the plastic cover (9) together with the display, **taking care not to dam-**

age the ribbon cable (between PCB and display).

2. Use a knife to cut an opening at the marked location (4).
3. Push the connector (11) with cable through the opening and secure the proximity switch (7) on the cover with a dot of glue.
4. Remove the jumper (8801-2267) at the socket X7 of the top board and insert the cable connector (11).
5. Guide the cable in such a manner that the plastic cover can be placed back onto the positioner. Insert the fixing screws (2) and screw tight. Attach the clamping plate (8) onto the proximity switch.
6. Attach the rotary switch (5). Make sure the flattened side of the positioner shaft is turned so that the rotary switch (5) can be attached with the metal tag next to the proximity switch.
7. On start-up of the positioner, set the option inductive alarm under Code 38 from ***No*** to ***YES***.



1	Cap	6	Metal tag
2	Screw	7	Proximity switch
3	Rotary pushbutton	8	Clamping plate
4	Marking	9	Plastic cover
5	Rotary switch	11	Connector

Fig. 26: *Retrofitting an inductive limit switch*

10 Maintenance

The positioner does not require any maintenance.

There are filters with a 100 µm mesh size in the pneumatic connections for supply and output which can be removed and cleaned, if required.

The maintenance instructions of any upstream supply air pressure reducing stations must be observed.

11 Servicing explosion-protected devices

If a part of the device on which the explosion protection is based needs to be serviced, the device must not be put back into operation until a qualified inspector has assessed it according to explosion protection requirements, has issued an inspection certificate or given the device a mark of conformity. Inspection by a qualified inspector is not required if the manufacturer performs a routine test on the device before putting it back into operation. Document the passing of the routine test by attaching a mark of conformity to the device. Replace explosion-protected components only with original, routine-tested components from the manufacturer.

Devices that have already been operated outside hazardous areas and are intended for future use inside hazardous areas must comply with the safety requirements placed on serviced devices. Before being operated inside hazardous areas, test the devices according to the specifications for servicing explosion-protected devices.

Read section 13 for maintenance, calibration and adjustment work inside and outside hazardous areas.

12 Firmware update (serial interface)

Firmware updates on positioners currently in operation can be performed as follows:

When updates are performed by a service employee appointed by SAMSON, the update is confirmed on the device by the test mark assigned by SAMSON's Quality Assurance.

In all other cases, only plant operator personnel with written approval may perform updates. Updates are to be confirmed by approved personnel on the device.

Laptops and PCs connected to the power supply must not be used without an additional protective circuit.

This does not apply to laptops in battery operation. In this case, it is assumed that a battery-powered laptop runs briefly for software programming or testing purposes.

a) **Updates outside the hazardous area:**
Remove the positioners from the plant. Update them outside the hazardous area.

b) **Updates on site:**
Updates on site are only permitted after the plant operator presented a signed hot work permit.

After updating has been completed, add the current firmware to the nameplate; this can be done using labels.

13 Maintenance, calibration and work on equipment

Interconnection with intrinsically safe circuits to check or calibrate the equipment inside or outside hazardous areas is to be performed only with intrinsically safe current/voltage calibrators and measuring instruments to rule out any damage to components relevant to explosion protection.

Observe the maximum permissible values specified in the certificates for intrinsically safe circuits.

14 Code list

Code no.	**Parameter** – Readings/ values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
0	**Operating mode** [MAN] Manual mode AUtO Automatic mode SAFE Fail-safe position ESC Cancel	Switchover from automatic to manual mode is bumpless. In fail-safe position, the ***S*** icon appears on the display. In MAN and AUtO mode, the system deviation is represented by the bar graph elements. The reading indicates the valve position or angle of rotation in % when the positioner is initialized. If the positioner is not initialized, the position of the lever in relation to the longitudinal axis is displayed in degrees (°).
1	**Manual w** [0] to 100 % of the nominal range	Adjust the manual set point with the rotary pushbutton. The current travel/angle is displayed in % when the positioner is initialized. If the positioner is not initialized, the position of the lever in relation to the longitudinal axis is indicated in degrees (°). ***Note:*** *It can only be selected when Code 0 = MAN*
2	**Reading direction** 1234, ⁴321, ESC	The reading direction of the display is turned by 180°.
3	**Enable configuration** [No], YES, ESC	Enables changing of data (automatically deactivated when the rotary pushbutton has not been operated for 120 s). FF blinks on the display when the on-site operation is locked. Codes marked with an asterisk (*) can only be read and not overwritten. Similarly, codes can only read over the SSP interface.
4*	**Pin position** [No], 17, 25, 35, 50, 70, 100, 200 mm, 90° with rotary actuators, ESC ***Note:*** *If you select a pin position in Code 4 that is too small, the positioner switches to SAFE mode for reasons of safety.*	Follower pin must be mounted in the proper position depending on the valve travel/opening angle. Pin position must be entered for nominal (NOM) or substitute (SUb) initialization. Pin position Code 4 / Standard Code 5 / Adjustment range Code 5 17 / 7.5 / 3.6 to 17.7 25 / 7.5 / 5.0 to 25.0 35 / 15.0 / 7.0 to 35.4 50 / 30.0 / 10.0 to 50.0 70 / 40.0 / 14.0 to 70.7 100 / 60.0 / 20.0 to 100.0 200 / 120.0 / 40.0 to 200.0 90° / 90.0 / 24.0 to 100.0

Code no.	**Parameter** – Readings/ values [default setting]	Description
5*	**Nominal range** mm or angle °, ESC	Nominal valve travel or opening angle must be entered for nominal (NOM) or substitute (SUb) initialization. The possible adjustment range depends on the pin position from the table for Code 4. Code 5 is generally locked until Code 4 is set to No, i.e. after a pin position has been entered, Code 5 can be configured. Indicates maximum travel/angle reached during initialization after initialization has been successfully completed.
6*	**Init mode** [MAX] Maximum range NOM Nominal range MAN Manual setting SUb Emergency mode ZP Zero calibration ESC Cancel	Select the initialization mode MAX: Travel/angle of the closure member from the CLOSED position to the opposite stop in the actuator. NOM: Travel/angle of the closure member measured from the CLOSED position to the indicated OPEN position. MAN: Manually selected range SUb: Substitute calibration (without initialization)
7*	**w/x** [↗↗] Increasing/increasing ↗↘ Increasing/decreasing ESC	Direction of action of the set point w in relation to the travel/angle x Automatic adaptation: AIR TO OPEN: On completing initialization, the direction of action remains increasing/ increasing (↗↗). A globe valve opens as the set point increases. AIR TO CLOSE: On completing initialization, the direction of action changes to increasing/decreasing (↗↘). A globe valve closes as the set point increases.
8*	**Travel/angle range start (lower x-range value)** [0.0] to 80.0 % of the nominal range, ESC ***Note:*** *Specified in mm or angle ° provided Code 4 is activated.*	Lower range value for travel/angle in nominal or operating range The **operating range** is the actual travel/angle of the valve and is limited by the lower travel/angle range value (Code 8) and the upper travel/angle range value (Code 9). Usually, the operating range and the nominal range are identical. The nominal range can be limited to the operating range by the lower and upper x-range values. The value is displayed or must be entered. The characteristic is adapted. See also the example in Code 9.

Code no.	**Parameter** – Readings/ values [default setting]	Description
9*	**Travel/angle range end (upper x-range value)** 20.0 to [100.0 %] of the nominal range, ESC ***Note:*** *Specified in mm or angle ° provided Code 4 is activated.*	Upper range value for travel/angle in nominal or operating range The value is displayed or must be entered. The characteristic is adapted. **Example:** The operating range is modified, for example, to limit the range of a control valve which has been sized too large. For this function, the entire resolution range of the set point is converted to the new limits. 0 % on the display corresponds to the adjusted lower limit and 100 % to the adjusted upper limit.
10*	**Travel/angle lower limit (lower x-limit)** 0.0 to 49.9 % of the operating range, [No], ESC	Limits travel/opening angle to the entered value (lower limit). The characteristic is not adapted. The characteristic is not adapted to the reduced range. See also example in Code 11.
11*	**Travel/angle upper limit (upper x-limit)** 50.0 to 120.0 %, [100 %] of the operating range, No, ESC	Limits travel/angle to the entered value (upper limit). The characteristic is not adapted. **Example:** In some applications, it is better to limit the valve travel, e.g. if a certain minimum medium flow is required or a maximum flow must not be reached. The lower limit must be adjusted with Code 10 and the upper limit with Code 11. If a tight-closing function has been set up, it has priority over the travel limitation. When set to No, the valve can be opened past the nominal travel with a set point outside of the 0 to 100 % range.
14*	**Reference variable range start (w-start)** 0.0 to 49.9 %, [1.0 %] of the span adjusted in Code 12/13, No, ESC	If the set point w reaches up to the entered percentage at the final value that causes the valve to close, the actuator is immediately completely vented (with AIR TO OPEN) or filled with air (with AIR TO CLOSE). This action always lead to maximum tight-closing of the valve. Codes 14/15 have priority over Codes 8/9/10/11. Codes 21/22 have priority over Codes 14/15.

Code no.	**Parameter** – Readings/ values [default setting]	Description
15*	**Reference variable range end (w-end)** 50.0 to 100.0 % of the span adjusted in Code 12/13, [No], ESC	If the set point w reaches up to the entered percentage at the final value that causes the valve to open, the actuator is immediately filled with air (with AIR TO OPEN) or completely vented (with AIR TO CLOSE). This action always lead to the valve being completely opened. The signal pressure can be limited in Code 16. Codes 14/15 have priority over Codes 8/9/10/11. Codes 21/22 have priority over Codes 14/15. **Example:** Set the end position w > to 99 % for three-way valves.
16*	**Pressure limit** 1.4, 2.4, 3.7 bar, [No], ESC	The signal pressure to the actuator can be limited in stages. After changing a pressure limit already set, the actuator must be vented once (e.g. by selecting the fail-safe position (SAFE) over Code 0). ***NOTICE*** *Do not activate pressure limitation for double-acting actuators (with closed position AIR TO OPEN).*
17*	**Proportional-action coefficient K_P (level)** 0 to 17, [7], ESC	Read or change K_P **Note concerning changing the K_P and T_V levels:** During positioner initialization, the values for K**P** and T**V** are optimally set. If the positioner tends to overshoot impermissibly due to other disturbances, the K_P and T_V levels can be adapted accordingly after initialization. Increment T_V level until desired behavior is reached or when the maximum value of 4 is reached, the K_P level can be decreased in increments. K_P level changes affect the set point deviation.
18*	**Derivative-action time T_V (level)** 1, [2], 3, 4, No, ESC	Read or change T_V (see K_P level) A change of the T_V level has no effect on the system deviation.
19*	**Tolerance band** 0.1 to 10.0 %, [5.0 %] of the operating range, ESC	Used for error monitoring. Determination of the tolerance band in relation to the operating range. Associated lag time (30 s) is a reset criterion. If a transit time is determined during initialization which is six times longer than 30 s, the six-fold transit time is accepted as the lag time.

Code no.	**Parameter** – Readings/ values [default setting]	Description
20*	**Characteristic** [0] to 9, ESC	Select characteristic 0 Linear 1 Equal percentage 2 Reverse equal percentage 3 SAMSON butterfly valve, linear 4 SAMSON butterfly valve, equal percentage 5 VETEC rotary plug valve, linear 6 VETEC rotary plug valve, equal percentage 7 Segmented ball valve, linear 8 Segmented ball valve, equal percentage 9 User-defined (defined over operator software) ***Note:*** *The various characteristics are listed in the Appendix (section 16).*
21*	**Required transit time OPEN (w ramp open)** [0] to 240 s, ESC	Time required to move through the operating range when the valve opens. Limitation of the transit time (Code 21 and 22): For some applications it is recommendable to limit the transit time of the actuator to prevent it from engaging too fast in the running process. Code 21 has priority over Code 15. ***NOTICE*** *The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.*
22*	**Required transit time CLOSED (w ramp closed)** [0] to 240 s, ESC	Time required to move through the operating range when the valve closes. Code 22 has priority over Code 14. ***NOTICE*** *The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.*
23*	**Total valve travel** [0] to 99 · 10^7, YES, ESC Exponential reading from 9999 travel cycles onwards	Totaled full valve travel cycle Can be reset to 0 by selecting ESC. ***Note:*** *The total valve travel is saved in a non-volatile memory after every 1000 full valve travel cycle.*

Code no.	**Parameter** – Readings/ values [default setting]	Description
24*	**LV total valve travel** 1000 to 99 · 10^7 [1.000000], ESC Exponential reading from 9999 travel cycles onwards	Limit value of total valve travel. If the limit is exceeded, the error message and the icon corresponding to the condensed state appear.
34*	**Closing direction** CL, [CCL], ESC	CL: Clockwise CCL: Counterclockwise Direction of rotation to reach the valve's CLOSED position (view onto rotary switch with positioner cover open). Needs only be entered in SUb initialization mode (Code 6).
35*	**Blocking position** [0.0] mm/° /%, ESC	Enter the blocking position (distance to CLOSED position) Only necessary with SUb initialization mode.
36*	**Reset** [----], Std, diAG, ESC	Std: Resets all parameters and diagnosis data to their default settings. After a reset, the positioner must be re-initialized. diAG: Resets diagnosis data only. Plotted reference graphs and logs remain saved. The positioner does not need to be re-initialized.
38*	**Inductive alarm** [No], YES, ESC	Indicates whether the inductive limit switch option is installed or not.
39	**Set point deviation e info** –99.9 to 99.9 %	Read only Indicates the deviation from the target position.
40	**Transit time Open info** [0] to 240 s	Read only Minimum opening time determined during initialization.
41	**Transit time Closed info** [0] to 240 s	Read only Minimum closing time determined during initialization.
42	**Auto-w/manual-w info** 0.0 to 100.0 % of the span	Read only Auto mode: Indicates the applied automatic set point. Man mode: Indicates the applied manual set point.

Code no.	**Parameter** – Readings/ values [default setting]	Description
43	**Firmware info control**	Read only Indicates the positioner type and current firmware version in alternating sequence.
44	**y info** [0] to 100 %, 0P, MAX, – – –	Read only Indicates the control signal y in % in relation to the travel range determined during initialization. MAX: The positioner builds up its maximum output pressure, see description in Code 14 and 15. 0P: The positioner vents completely, see description in Code 14 and 15. – – –: The positioner is not initialized.
45	**Solenoid valve info** YES, HIGH/LOW, No	Read only Indicates whether a solenoid valve is installed or not. If a voltage supply is connected at the terminals of the installed solenoid valve, YES and HIGH appear on the display in alternating sequence. If a voltage supply is not connected (actuator vented, fail-safe position indicated on the display by the S icon), YES and LOW appear on the display in alternating sequence.
46*	**Bus address** 16 to 251, ESC	Bus address 16 to 247: Positioners with fixed bus address 248 to 251: Positioners without fixed bus address (new or decommissioned positioners)
47*	**Write protection FF** YES, [No], ESC	When write protection is active, device data can be read using FF communication but not overwritten.
48* **49***	**Diagnostic parameters ▶ EB 8389 EN**	

Note:
The error codes listed in following appear in the display corresponding to their status classification set over the condensed state (Maintenance required/Maintenance demanded: 🔧, Out of specification: 🔧 blinking, Maintenance alarm: ▮). If "No message" is assigned to the error code as the status classification, the error is not included in the condensed state.
A status classification is assigned to every error code in the default setting. The status classification of error codes can also be changed as required using an operator software (e.g. TROVIS-VIEW).

Initialization errors

Error codes – Recommended action		Condensed state message active. When prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
50	**x > permissible range**	Value of measuring signal too high or too low; the lever operates near its mechanical stops. • Pin not mounted properly • Bracket slipped in case of NAMUR attachment or positioner is off center. Follower plate not mounted properly.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and pin position, set operating mode from SAFE to MAN and re-initialize the positioner.
51	**Δx < permissible range**	Insufficient measuring span of the lever. • Pin not mounted properly • Wrong lever An angle of rotation smaller than 16° at the positioner shaft only generates an alarm. An angle below 9° leads to the initialization being canceled.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and re-initialize the positioner.

Error codes – Recommended action		Condensed state message active. When prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
52	**Attachment**	• Invalid positioner attachment. • Nominal travel/angle (Code 5) could not be achieved during NOM initialization (no tolerance downwards permissible). • Mechanical or pneumatic fault, e.g. wrong lever selected or supply pressure too low to move to the required position.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and supply pressure. Re-initialize the positioner. Under certain circumstances, it may be possible to check the maximum travel/angle by entering the actual pin position and then performing a MAX initialization. After initialization has been completed, the Code 5 indicates the maximum achieved travel or angle.
53	**Initialization time exceeded (Init time >)**	Initialization takes too long. The positioner returns to the previous operating mode. • No pressure in supply line or pneumatic leakage • Supply air failure during initialization
	Status classification	[Maintenance required]
	Recommended action	Check attachment and supply air line. Re-initialize the positioner.
54	**Initialization – solenoid valve**	1) A solenoid valve is installed (Code 45 = YES) and has not been connected or not properly. As a result, actuator pressure cannot build up. The alarm is generated when you attempt to initialize the positioner. 2) If you attempt to initialize the positioner from the fail-safe position (SAFE).
	Status classification	[Maintenance required]
	Recommended action	1) Check connection and supply voltage of the solenoid valve (Code 45 High/Low). 2) Set the MAN mode in Code 0. Then initialize the positioner.
55	**Transit time too short (transit time <)**	Actuator transit times detected during initialization are so short that optimal positioner tuning is impossible.
	Status classification	[Maintenance required]
	Recommended action	Check the volume restriction setting as described in section 7.2. Re-initialize the positioner.

Error codes – Recommended action		Condensed state message active. When prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
56	**Pin position**	Initialization canceled because selected NOM and SUB initialization modes require the pin position to be entered.
	Status classification	[Maintenance required]
	Recommended action	Enter pin position over Code 4 and nominal travel/angle over Code 5. Re-initialize the positioner.

Operational error

Error codes – Recommended action		Condensed state message active. When prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
57	**Control loop**	Control loop error, the valve no longer follows the controlled variable within tolerable times (tolerance band alarm Code 19). • Actuator blocked • Positioner attachment shifted subsequently • Supply pressure no longer suffices.
	Status classification	[Maintenance required]
	Recommended action	Check attachment.
58	**Zero**	Zero point incorrect Error can occur when the positioner's attachment position is shifted or when the valve trim is worn, particularly with soft-sealed plugs.
	Status classification	[Maintenance required]
	Recommended action	Check valve and attachment of the positioner. If OK, perform a zero calibration over Code 6 (see section 7.7). We recommend to re-initialize the positioner if zero deviates by more than 5 %.
59	**Auto-correction**	Errors in the positioner's data section are detected detected by automatic monitoring and corrected automatically.
	Status classification	[No message]
	Recommended action	Automatic

Error codes – Recommended action		Condensed state message active. When prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
60	**Fatal error**	Error in safety-relevant data that cannot be corrected automatically. Possible cause: EMC disturbances. The valve is moved to fail-safe position.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Reset over Code 36. Re-initialize the positioner.

Hardware error

Error codes – Recommended action		Condensed state message active. When prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
62	**x signal**	Actuator's measured value recording failed. The conductive plastic element is defective. The device continues functioning in emergency mode but it must be replaced as quickly as possible. The emergency mode on the display is indicated by a blinking closed-loop operation icon and 4 dashes instead of the position reading. ***Note on the open-loop operation:*** *If the measuring system has failed, the positioner is still in a reliable state. The positioner switches to emergency mode where the position cannot be accurately controlled anymore. However, the positioner continues operation according to its set point so that the process remains in a safe state.*
	Status classification	[Maintenance demanded]
	Recommended action	Return positioner to SAMSON AG for repair.
64	**i/p converter (y)**	Current circuit of i/p converter interrupted.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Cannot be remedied. Return positioner to SAMSON AG for repair.

Error appendix

Error codes – Recommended action		Condensed state message active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
65	**Hardware**	Initialization key jammed (firmware version R 1.51 and higher) A hardware error has occurred. The positioner changes to the fail-safe position (SAFE).
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Confirm error and return to automatic mode, or perform a reset and re-initialize the positioner. If this is not successful, return positioner to SAMSON AG for repair.
66	**Data memory**	No more data can be written to the memory, e.g. because written data deviate from read data. The valve moves to the fail-safe position.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Return positioner to SAMSON AG for repair.
67	**Check calculation**	Hardware controller monitored by test calculation.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Confirm error. If this is not possible, return positioner to SAMSON AG for repair.

Data error

Error codes – Recommended action		Condensed state message active. When prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
68	**Control parameters**	Error in control parameters.
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform a reset and re-initialize the positioner.
69	**Potentiometer parameters**	Error in digital potentiometer parameters
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform a reset and re-initialize the positioner.

Error codes – Recommended action		Condensed state message active. When prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
70	**Calibration**	Error in data from production calibration. The positioner continues operation with cold start values.
	Status classification	[Maintenance required]
	Recommended action	Return positioner to SAMSON AG for repair.
71	**General parameters**	Error in parameters not critical to control operation.
	Status classification	[Maintenance required]
	Recommended action	Confirm error. Check and, if necessary, change the settings of the require parameters.
73	**Internal device error 1**	Internal device error
	Status classification	[Maintenance required]
	Recommended action	Return positioner to SAMSON AG for repair.
74	**FF parameters**	Error in parameters not critical to control operation.
	Status classification	[Maintenance required]
	Recommended action	Confirm error and perform a reset.
76	**No emergency mode**	The travel measuring system of the positioner has a self-monitoring function (see Code 62). An emergency mode (open-loop control) is not available for certain actuators, such as double-acting actuators. In case of a travel sensing error, the positioner vents the output (Output 38) or A1 in double-acting actuators. During the initialization, the positioner automatically checks whether the actuator has such a function or not.
	Status classification	[No message]
	Recommended action	Merely information, confirm, if necessary. No further action required.

Error codes – Recommended action		Condensed state message active. When prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
77	**Software loading error**	When the positioner starts operation for the first time after the FF signal has been applied, it carries out a self-test (***tEStinG*** runs across the display). If the positioner loads the wrong software, the valve moves to the fail-safe position. It is not possible to make the valve leave this fail-safe position again.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Interrupt fieldbus signal and restart the positioner. If not successful, return positioner to SAMSON AG for repair.
78	**Option parameters**	Error in option parameters.
	Status classification	[Maintenance required]
	Recommended action	Return positioner to SAMSON AG for repair.

Diagnosis errors

Error codes – Recommended action		Condensed state message active. When prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
79	**Diagnostic messages**	Messages generated by the extended diagnostics
	Status classification	Maintenance required (cannot be classified)
80	**Diagnostic parameters**	Error in parameters not critical to control operation.
	Status classification	Maintenance required (cannot be classified)
	Recommended action	Confirm error. Check and, if necessary, perform a new reference test.
81	**Reference graphs**	Error occurred during plotting the reference graphs for drive signal y steady-state or drive signal y hysteresis. • Reference test canceled • Reference line for drive signal y steady-state or drive signal y hysteresis was not adopted.
	Status classification	[No message]
	Recommended action	Check and, if necessary, perform a new reference test.

14.1 Decimal values of the modes in the FOUNDATION™ fieldbus blocks (Code 48)

Mode	Decimal value
AUTO	8
AUTO/CAS	12
AUTO/RCAS	134
O/S	128
MAN	16

14.2 Decimal values of the states in the FOUNDATION™ fieldbus blocks (Code 48)

Status	Decimal value
Good (NC) – Non-specific	128
Good (NC) – Active block alarm	132
Good (NC) – Active advisory alarm	136
Good (NC) – Active critical alarm	140
Good (NC) – Unack block alarm	144
Good (NC) – Unack advisory alarm	148
Good (NC) – Unack critical alarm	152
Uncertain – Non-specific	64
Uncertain – Last usable value	68
Uncertain – Substitute/manual entry	72
Uncertain – Initial value	76
Uncertain – Sensor conversion not accurate	80
Uncertain – Engineering unit range violation	84
Uncertain – Sub-normal	88
Good (C) – Non-specific	192
Good (C) – Initialization acknowledge	196
Good (C) – Initialization request	200

Status	Decimal value
Good (C) – Not invited	204
Good (C) – Not selected	208
Good (C) – Local override	216
Good (C) – Fault state active	220
Bad – Non-specific	0
Bad – Configuration error	4
Bad – Not connected	8
Bad – Device failure	12
Bad – Sensor failure	16
Bad – No comm., with last usable value	20
Bad – No comm., no last usable value	24
Bad – Out of service	28

15 Dimensions in mm

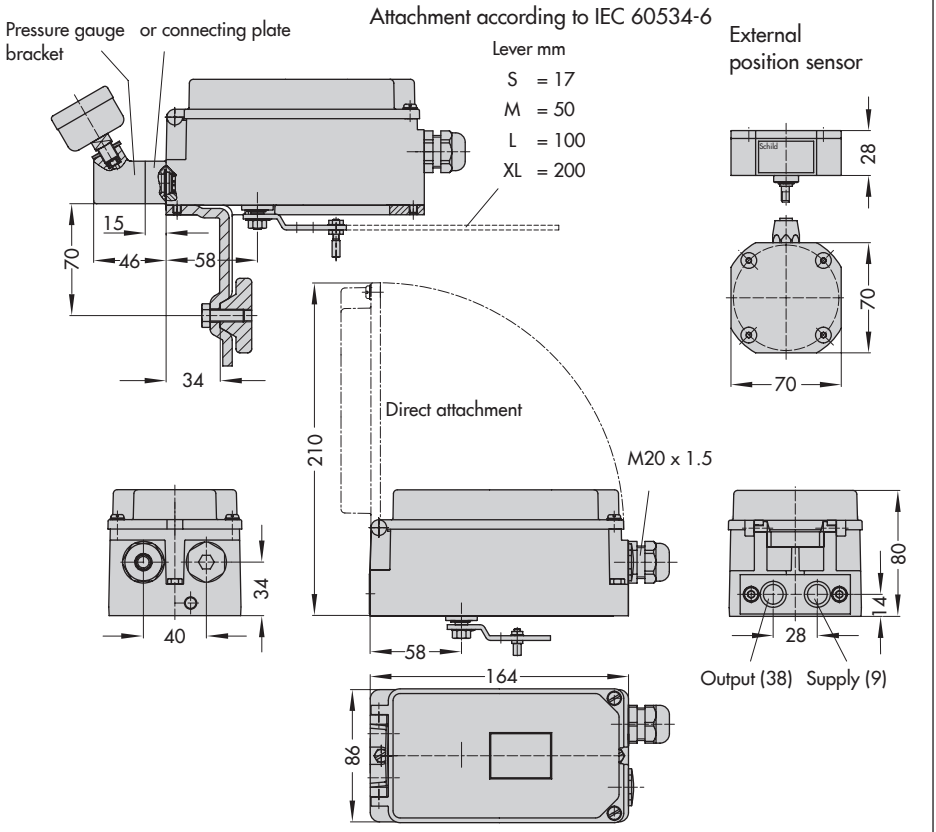


Fig. 27: *NAMUR and direct attachment*

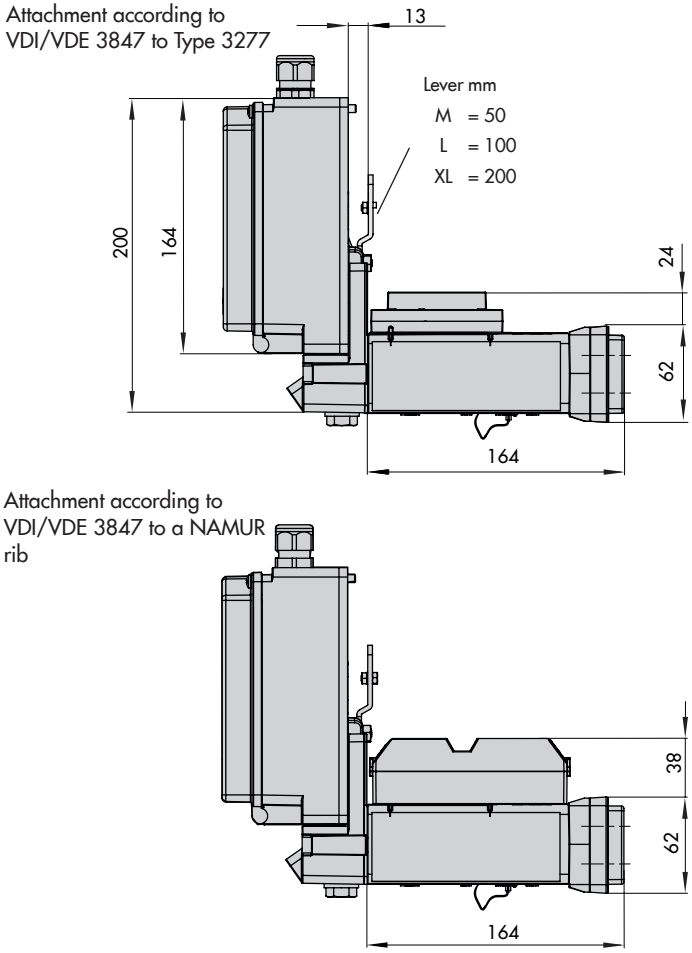
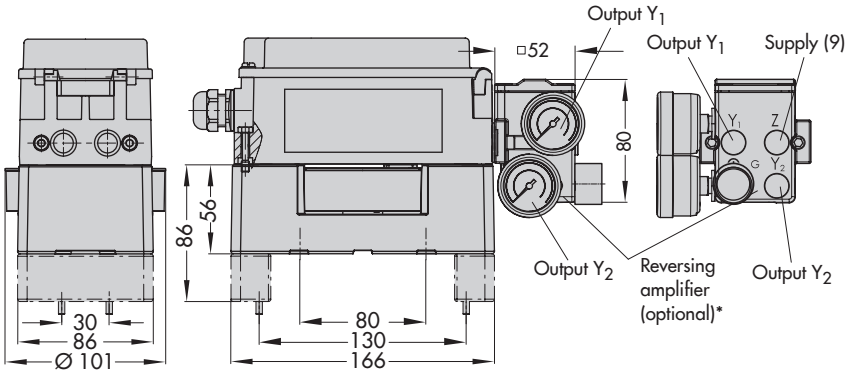
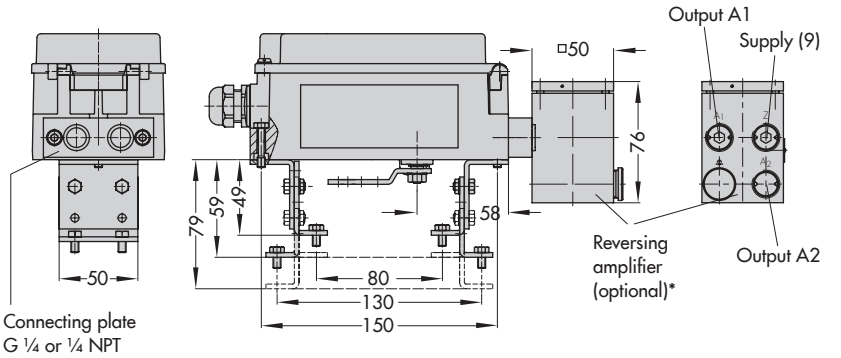


Fig. 28: *Attachment according to VDI/VDE 3847*

Heavy-duty version



Light version

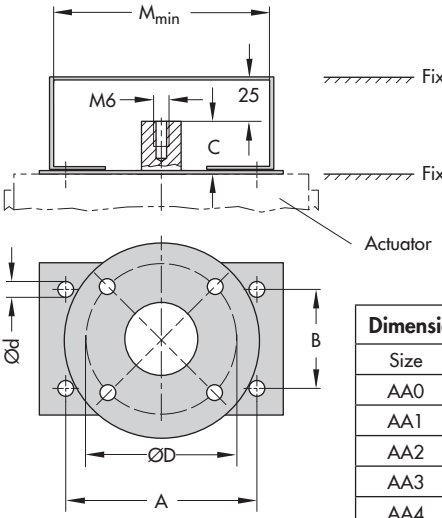


* Reversing amplifier

- Type 3710 (see drawing of heavy-duty version for dimensions)
- 1079-1118/1079-1119, no longer available (see drawing of light version for dimensions)

Fig. 29: *Attachment to rotary actuators acc. to VDI/VDE 3845 (Sept. 2010), fixing level 1, AA1 to AA4 size*

15.1 Fixing levels according to VDI/VDE 3845 (September 2010)



Dimensions in mm						
Size	A	B	C	Ød	M_{min}	D*
AA0	50	25	15	5.5 for M5	66	50
AA1	80	30	20	5.5 for M5	96	50
AA2	80	30	30	5.5 for M5	96	50
AA3	130	30	30	5.5 for M5	146	50
AA4	130	30	50	5.5 for M5	146	50
AA5	200	50	80	6.5 for M6	220	50

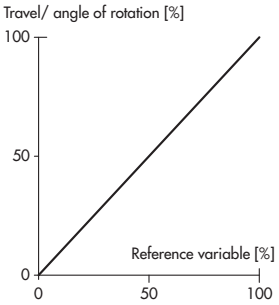
* Flange type F05 according to DIN EN ISO 5211

16 Valve characteristic selection

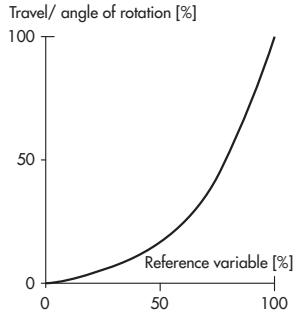
The characteristics that can be selected in Code 20 are shown in following in graph form.

Note:
A characteristic can only be defined (user-defined characteristic) using a workstation/operating software (e.g. TROVIS-VIEW).

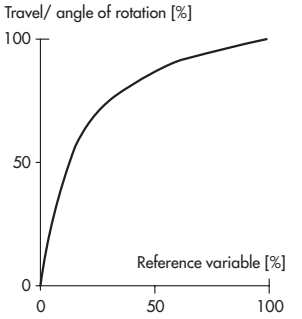
Linear (select characteristic: 0)



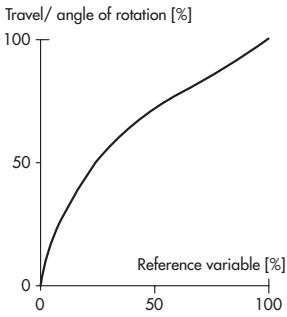
Equal percentage (select characteristic: 1)



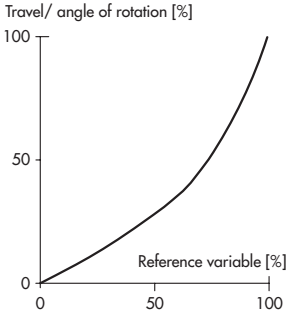
Reverse equal percentage (select characteristic: 2)



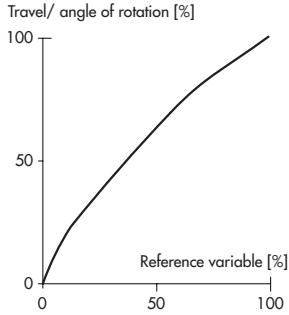
SAMSON butterfly valve linear (select characteristic: 3)



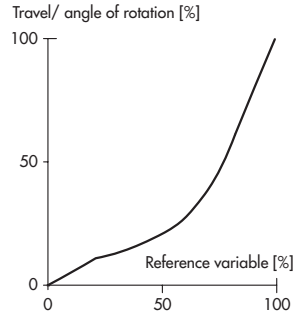
SAMSON butterfly valve equal percentage (select characteristic: 4)



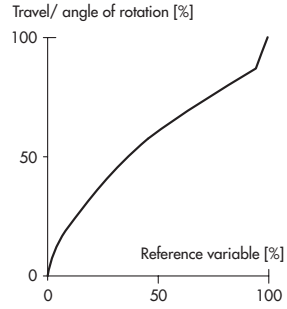
VETEC rotary plug valve linear (select characteristic: 5)



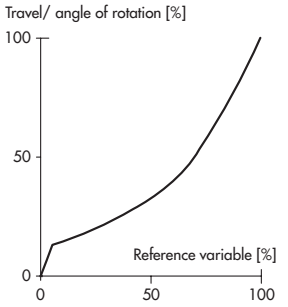
VETEC rotary plug valve equal percentage (select characteristic: 6)



Segmented valve ball linear (select characteristic: 7)



Segmented valve ball equal percentage (select characteristic: 8)



VDE
VDE Prüf und Zertifizierungsinstitut

TRANSLATION

Offenbach, 2005-11-21

Your ref.	Your letter	Our ref.	Contact
P. Opl	2005-11-08	479000-9010-0001/67325 FG33/bhl-wah	H. Biehl Tel. (069) 8306-249 Fax (069) 8306-716 gerhard.biehl@vde.com

Test report for Information of the Applicant

Testing of the Degree of Protection on enclosures of Type 3730 and Type 3731 Positioners

This test report contains the result of a single investigation carried out on the product submitted. A sample of this product was tested to found the accordance with the thereafter listed standards resp. parts of standards.

The test report does not entitle to use a VDE Certification mark and the *"GS = geprüfte Sicherheit (test safety)"* and does not refer to all VDE specifications applicable to the tested product.

This report may only be passed to a third party in its complete wording including this preamble and the date of issue.

Any publication or reproduction requires the prior written approval of the VDE Testing and Certification Institute.

1 Assignment

The samples described in 2 below were tested for compliance with the IP 66 degree of protection.

2 Samples

2.1 Type 3730 Positioner

2.2 Type 3731 Positioner

VDE
VDE Prüf und Zertifizierungsinstitut

3 Basis of assessment

DIN EN 60529/VDE 0470 Part 1/2000-09
Degree of protection provided by enclosures (IP Code)
German version EN 60529:1999+A1:2000

4 Execution of the tests

The dust test had already been carried out on the Type 3730 Positioner under the reference number: 479000-9010-0001/32752 and on the Type 3731 Positioner under the reference number: 479000-9010-0001/58985 with suction as per category 1 at the connecting enclosures of the positioners and solenoid valves. The under pressure was 2 kPa and the test lasted 8 hours.

5 Test results

The testing of the samples described in 2 above yielded the following results:

Protecting against access to hazardous parts and against ingress of solid foreign objects according to DIN EN 60529/VDE 0470 Part 1:2000-09	**IP6X satisfied**
Protecting against ingress of water according to DIN EN 60529/VDE 0470 Part 1:2000-09	**IPX6 satisfied**

The positioner enclosures in the versions submitted meet the requirements of IP 66 degree of protection.

There was no ingress of either dust or water.

VDE- Prüf- und Zertifizierungsinstitut
Fachgebiet FG33

(Signature) (Signature)

Gerhard Biehl

VDE VERBAND DER ELEKTROTECHNIK
ELEKTRONIK INFORMATIONSTECHNIK e.V

Testing and Certification Institute
Merianstrasse 28
D-63069 Offenbach

Prüfbericht VDE n. EN 60529 IP-Schutzart.doc 2 *e-mail: vde-institut@vde.com*

IECEx Certificate of Conformity

Certificate No.: IECEx PTB 06.0054

Date of Issue: 2006-11-02 Issue No.: 0

Page 2 of 4

Manufacturer: **SAMSON AG Mess- und Regeltechnik**
Weismuellerstrasse 3
D-60314 Frankfurt am Main
Germany

Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2004 Edition: 4.0	Electrical apparatus for explosive gas atmospheres - Part 0: General requirements
IEC 60079-11 : 1999 Edition: 4	Electrical apparatus for explosive gas atmospheres - Part 11: Intrinsic safety 'i'

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:

DE/PTB/ExTR06.0086/00

Quality Assessment Report:

DE/TUN/QAR06.0011/00

Seite 2 von 4

IECEx Certificate of Conformity

Certificate No.: IECEx PTB 06.0054

Date of Issue: 2006-11-02 Issue No.: 0

Page 2 of 4

Manufacturer: SAMSON AG Mess- und Regeltechnik
Weismuellerstrasse 3
D-60314 Frankfurt am Main
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STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2004 Edition: 4.0 — Electrical apparatus for explosive gas atmospheres - Part 0: General requirements

IEC 60079-11 : 1999 Edition: 4 — Electrical apparatus for explosive gas atmospheres - Part 11: Intrinsic safety 'i'

This Certificate does not indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:

DE/PTB/ExTR06.0086/00

Quality Assessment Report:

DE/TUN/QAR06.0011/00

IECEx Certificate of Conformity

Certificate No.: **IECEx PTB 06.0054**

Date of Issue: **2006-11-02** Issue No.: 0

Page 3 of 4

Schedule

EQUIPMENT:
Equipment and systems covered by this certificate are as follows:

The Model **3730-41 and 3730-51** i/p-Positioners are bus-powered field devices with communication capability and serve for adjusting the valve stem positions in compliance with a control signal. They are intended for attachment to either linear or rotary actuators.

Communication with field devices programmable logic control systems and distributed control systems is optionally either according to Profibus PA (Model 3730-41 . .), or in accordance with the FOUNDATION™ Fieldbus Specification (Typ 3730-51 . .).

For further information see annexe.

CONDITIONS OF CERTIFICATION: NO

IECEx Certificate of Conformity

Certificate No.: **IECEx PTB 06.0054**

Date of Issue: **2006-11-02** Issue No.: 0

Page 4 of 4

Additional information:

for further information see annex

Annexe: 3730-41_51 Technical Data.pdf

Annex to Certificate of Conformity IECEx PTB 06.0054

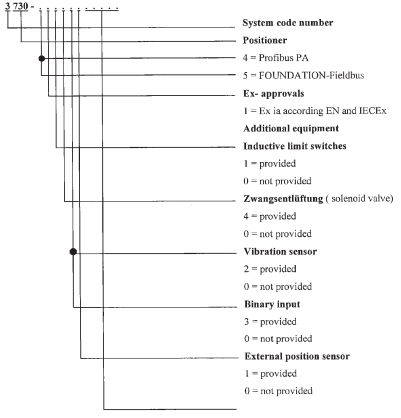
Equipment:	Model 3730-41 Profibus PA Positioner Model 3730-51 FOUNDATION FF Positioner	
Submitted by:	SAMSON AG Mess- und Regeltechnik Weismüllerstrasse 3, 60314 Frankfurt	
Manufactured by:	SAMSON AG Mess- und Regeltechnik Weismüllerstrasse 3, 60314 Frankfurt	
Groups:	**IIC / IIB**	
Type of Protection:	**ia**	
Temperature Classification:.	**T6 / 60°C**	
Degree of Ingress Protection:	**IP 54 IP 65 und IP 66**	

Conditions of Manufacture

Routine testing and high-voltage testing between the individual circuit and the enclosure with 500V, 50Hz, 1min.

Schedule

The positioners come in several versions. The following model designation code applies:



Annex to Certificate of Conformity IECEx PTB 06.0054

Connections

Pneumatic connections

Electric connections

1+2 = M 20x1,5 (plastic)

5+6 = M 20x1,5 (metal)

The dots in the model designation code will be substituted for numerals identifying the equipment version

Scope

Ex ia IIC/IIB T6 ; -40°C ≤ ta ≤ T6 60°C / -40°C ≤ ta ≤ T5 70°C / -40°C ≤ ta ≤ T4 80°C ; IP 54 or IP 65

"Testing and assessment according IEC 60079-0 and 60079-11" type of protection Ex ia IIC T6 degree of protection IP 54 and IP 65 according to IEC 60529

Table: Summary of results

	FOUNDATION Fieldbus				**FISCO**			
Group	**IIC**		**IIB**		**IIC**		**IIB**	
U [V]	24		24		20		24	
I [mA]	174(1)	360(2)	433(1)	380(2)	309(1)	360(2)	433(1)	380(2)
P [W]	2,08(1)	1,04(2)	5,16(1)	2,58(2)	3,09(1)	1,54(2)	5,16(1)	2,58(2)

I(1) = maximum current for intrinsically safe resistive circuits according to EN 50020

I(2) = maximum current according to Profibus User Organization

P(1) = maximum power in the intrinsically safe circuit upon matching

P(2) = maximum power in consumer upon matching

Model 3730-41 and 3730-51 i/p Positioners – Permissible maximum values for intrinsic safety according to EG Type Examination Certificate PTB 04 ATEX 2109

The Model 3730-41 and 3730-51 i/p Positioners are bus-powered field devices with communication capability and serve for adjusting the valve stem positions incompliance with a control signal. They are intended for attachment to either linear or rotary actuators.

Communication is optionally either according to Profibus PA in compliance with the FISCO concept (Typ 3730-41) or in accordance with the FOUNDATION™ Fieldbus Specification (Typ 3730-51)

The Model Typ 3730-41 and 3730-51 are passive two-terminal networks which may be connected to all certified intrinsically safe circuits, provided the permissible maximum values of Ui, Ii und Pi are not exceeded.

For instrument air noncombustible media are used.

The equipment is intended for use in hazardous locations.

The correlation between temperature classification and the permissible ambient temperature ranges is shown in the table below:

Temperature class	Permissible ambient temperature ranges
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

Electrical data

BUS connection signal circuit (terminals 11/12)

Type of protection:
Intrinsic safety Ex ia IIC/IIB
only for connection to an intrinsically safe circuit

The correlation between the type of protection and the electrical data is shown in the tables below:

Maximum values: **Model 3730-4..**

Profibus PA
Ex ia IIC/IIB
Ui = 17,5 V DC
Ii = 380 mA
Pi = 5.32 W

Maximum values: **Model 3730-5..**

FOUNDATION™	
Ex ia IIC	Ex ia IIB
Ui = 24 v DC	Ui = 24 DC
Ii = 360 mA	Ii = 380 mA
Pi = 5.32 W	Pi = 2.58 W

Ci = 5 nF; Li = 10 µH

Limit switch, inductive (terminals 41/42)

Type of protection: Intrinsic safety EEx ia IIC,
only for connection to an intrinsically safe circuit

Maximum values:

Ui = 16 V; Ii = 52 mA;
Pi = 169 mW

Li = 100 µH; Ci = 30 nF

or

Ui = 16 V; Ii = 25 mA:
Pi = 64 mA

Li = 100 µH; Ci = 30 nF

The correlation between temperature classification and the permissible ambient temperature ranges, maximum short-circuit currents and maximum power of the analyzers is shown in the table below:

Temperature classe	Permissible ambient temperature ranges	I_o / P_o
T6 T5 T4	+45°C -40°C ... +60°C +75°C	52mA / 169mW
T6 T5 T4	+60°C -40°C...+80°C +80°C	25mA / 64mW

Forced venting function (terminals 81/82)

Type of protection: Intrinsic safety Ex ia IIC
only for connection to an intrinsically safe circuit

Maximum values:

Ui = 28 V, Ii = 115 mA
Pi = 500 mW

Li = negligible
Ci = 5.3 nF

Binary input 1 (terminals 87/88)

Type of protection: Intrinsic safety Ex ia IIC/IIB
only for connection to an intrinsically safe circuit

Maximum values:

Ui = 30 V, Ii = 100 mA

Li and Ci = negligible

Binary input 2 (terminals 87/88)

Type of protection: Intrinsic safety Ex ia IIC/IIB
only for connection to an intrinsically safe circuit

Maximum values:

U_o = 5,88 V, I_o = 1 mA
P_o = 7,2 mW

The correlation between the type of protection and the permissible external capacitances and inductances is shown in the table below:

Ex ia IIC	Ex ia IIB
C_o = 2 µF	C_o = 4 µF
L_o = 10 mH	L_o = 1 H

Li and Ci negligible

Serial interface BU

Type of protection: Intrinsic safety Ex ia IIC

Maximum values:

Annex to Certificate of Conformity IECEx PTB 06.0054

U_o = 8,61 V, I_o = 55 mA
P_o = 250 mW

The correlation between the type of protection and the permissible external capacitances and inductances is shown in the table below

Ex ia IIC	Ex ia IIB
C_o = 0,61 µF	C_o = 4 µF
L_o = 9 mH	L_o = 9 mH

Only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 16 V, I_i = 25 mA
P_i = 64 mW

Li and Ci negligible

In case of interconnection the rules for interconnecting intrinsically safe circuits shall be complied with.

External position sensor
(analog pcb, pins p9, p10, p11)

Type of protection: Intrinsic safety Ex ia IIC

Maximum values:

U_o = 8,61 V, I_o = 55 mA
P_o = 250 mW

The correlation between the type of protection and the permissible external capacitances and inductances is shown in the table below:

Ex ia IIC	Ex ia IIB
C_o = 0,61 µF	C_o = 4 µF
L_o = 9 mH	L_o = 9 mH

Li = 370 µH, Ci = 730 nF

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

(1) **EC TYPE EXAMINATION CERTIFICATION**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**

(3) EC Type Examination Certificate Number

PTB 04 ATEX 2109

(4) Equipment: Model 3730-4.. and 3730-5.. I/P Positioners

(5) Manufacturer: SAMSON AG, Mess- und Regeltechnik

(6) Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

(7) The equipment and any acceptable variations thereof are specified in the schedule to this certificate.

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 in according to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres as specified in Annex II to the Directive.

The examination and test results are recorded in confidential report PTB Ex 04-24202.

(9) The Essential Health and Safety Requirements are satisfied by compliance with

EN 50014:1997+A1+A2 EN 50020:2002 EN 50281-1-1:1998

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included. Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

(11) This EC Type Examination Certificate relates only to the design and examination of the specified equipment in compliance with Directive 94/9/EC Further requirements of this Directive apply to the manufacture and supply of this equipment. These requirements are not covered by this Certificate.

(12) The marking of the equipment shall include the following:

II 2G EEx ia IIC T6 and II 2D IP 65 T 80 °C

Zertifizierungsstelle Explosionsschutz Braunschweig, 25 October 2004
By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

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Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig
Ptb47-3730-41-51.doc

(13) **S c h e d u l e**

(14) **EC TYPE EXAMINATION CERTIFICATE No. PTB 04 ATEX 2109**

(15) **Description of Equipment**

The Model 3730-4 and 3730-5.. I/P Positioners are bus-powered field devices with communication capability and serve for adjusting valve stem positions in compliance with a control signal. They are intended for attachment to linear or rotary actuators.

Communication is optionally either according to Profibus PA incompliance with the FISCO concept (Model 3730-4..) or in compliance with the FOUNDATION™ Fieldbus Specification (Model 3730-5..)

The Model 3730-4.. and 3730-5.. I/P Positioners are passive two-terminal networks which may be connected to any certified intrinsically safe circuit, provided the permissible maximum values for Ui, Ii and Pi are not exceeded.

For air supply non-combustible media are used.

The devices are intended for use inside the hazardous locations.

The correlation between temperature classification, permissible temperature ranges is shown in the tables below:

Temperature class	Permissible ambient temperature range
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

Electrical data

BUS connection, signal circuit (terminals 11/12)

Type of protection: Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

The correlation between type of protection and the electrical data is shown I the table

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Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt **PTB**
Braunschweig und Berlin

Maximum values:
Model 3730-4..

EEx ia IIC/IIB
Ui 17,5 V DC
Ii = 380 mA
Pi = 5.32 W

or
Model 3730-5..

FOUNDATION™	
EEx ia IIC	EEx ia IIB
Ui = 24 v DC	Ui = 24 DC
Ii = 360 mA	Ii = 380 mA
Pi = 5.32 W	Pi = 2.58 W

Ci = 5 nF; Li = 10 µH

Inductive proximity switch (terminals 11/12)

Type of protection. Intrinsic safety EEx ia IIC, only for connection to a certified intrinsically safe circuit

Maximum values

Ui = 16 V
Ii = 52 mA
Pi = 169 mW

Li = 100 µH
Ci = 30 nF

or

Ui = 16 V
Ii = 25 mA
Pi = 64 mA

Li = 100 µH
Ci = 30 nF

The correlation between temperature classification, the permissible ambient temperature ranges, the maximum short-circuit currents and the maximum power for analyzers is shown in the table below

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Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig
Ptb47-3730-41-51.doc

Temperature class	Permissible ambient temperature range	I_o / P_o
T6	45°C	52mA / 169mW
T5	-40°C ...60°C	
T4	75°C	
T6	60°C	25mA / 64mW
T5	-40°C...80°C	
T4	80°C	

Forced venting function (terminals 81/82)

Type of protection: Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 28 V
Ii = 115 mA
Pi 500 W

Li = negligible
Ci = 5.3 nF

Binary input 1 (terminals 87 / 88)

Type of protection: Intrinsic safety EEx ia IIC/IIB for connection of an active contact circuit

Maximum values:

Ui = 30 V
Ii = 100 mA

Li = negligible
Ci = negligible

Binary input 2 (terminals 85 / 86)

Type of protection: Intrinsic safety EEx ia IIC/IIB for connection of an active contact circuit

Maximum values:

U_o = 5,88 V
I_o = 1 mA
P_o = 7,2 mW

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

EEx ia IIC	EEx ia IIB
C_o = 2 µF	C_o = 4 µF
L_o = 10 mH	L_o = 1 H

Ci = negligible
Li = negligible

Serial interface BU

Type of protection. intrinsic safety EEx ia IIC

U_o = 8,61 V
I_o = 55 mA
P_o = 250 mW

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

EEx ia IIC	EEx ia IIB
C_o = 0,61 µF	C_o = 4 µF
L_o = 9 mH	L_o = 9 mH

only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 16 V
Ii = 25 mA
Pi = 64 mW

Li = negligible
Ci = negligible

For interconnection, the rules for interconnecting intrinsically safe circuits shall be complied with

External positioner sensor (analog PCB pins p9, p10, p11)

Type of protection: Intrinsic safety EEx ia IIC

Maximum values:

U_o = 8,61 V
I_o = 55 mA
P_o = 250 mW

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

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Braunschweig und Berlin

PTB

EEx ia IIC	EEx ia IIB
C_o = 0,61 µF	C_o = 4 µF
L_o = 9 mH	L_o = 9 mH

Li = 370 µH
Ci = 730 nF

(16) Test Report: **PTB Ex 04-24202**

(17) **Special conditions for safe use**

None

(18) **Special Health and Safety Requirements**

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 25 October 2004

(Signature) (seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

ADDENDUM No.: 1

in compliance with Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 04 ATEX 2109

Equipment:	Model 3730-41.. and 3730-51
Marking:	Ex II 2G EEx ia IIC T6 and Ex II 2D IP 65 T80°C
Manufacturer:	SAMSON AG Mess- und Regeltechnik
Address:	Weismüllerstr. 3, D-60314 Frankfurt, Germany

1. Description of the additions and modifications

The Model 3730-4.. and 3730-5.. are permitted to be manufactured in the future also in compliance with the documents specified in the Test Report. The input wiring of the bus connection circuit has been modified and the pcb layout has been adapted.

The clause below replaces Clause (15) Para. 2 of the EC Type Examination Certificate.

"Bus connection (coupling) can be made according to the FISCO Concept both for the Profibus PA and the Foundation ™ Fieldbus Specification."

The tabular presentation of the electrical data relating to the bus connection signal circuit has been modified:

"BUS connection signal circuit … (Terminals 11/12)	Type of protection EEx ia IIC/IIB only for connection to a certified intrinsically safe circuit.

The interrelationship between type of protection and the electrical data is shown in the table below.

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Braunschweig und Berlin

PTB

Addendum No. 1 to the EC Type Examination Certificate PTB 04 ATEX 2109

Maximum values:

Model 3730-4 .. and 3730-5 .. resp.

FISCO supply unit	BUS supply unit, general	
EEx ia IIC/IIB	EEx ia IIC	EEx ia IIB
U_i = 17,5 V DC	U_i = 24 V DC	U_i = 24 V DC
I_i = 380 mA	I_i = 360 mA	I_i = 380 mA
P_i = 5,32 W	P_i = 1,04 W	P_i = 2,56 W

C_i = 5 nF
L_i = 10µH

All the other electrical data and other data specified in the EC Type Examination certificate apply also this Amendment No. 1

Test report: **PTB Ex 06-26085**

Zertifizierungsstelle Explosionsschutz
By order

(Signature)
Dr.-Ing. U. Johannsmeyer
Director and Professor
(Seal)

Braunschweig, 13 July 2005

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Ptb47-3730-41/51Add-1.doc

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

ADDENDUM No.: 2

in compliance with Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 04 ATEX 2109

Equipment: Model 3730-4- .. and Model 3730-5 … Positioners

Marking: **II 2 G EEx ia IIC T 6 and**
II 2 D IP 65 T 80 °C

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Weismüllerstrasse 3
60314 Frankfurt am Main, Germany

Description of the additions and modifications
The Model 3730-4 … and 3730-5.. Positioners are permitted to be manufactured in the future also in compliance with the test documents specified in the Test Report.

The electrical data of the forced ventilation modules of the Models 3730-41 and 3750-51 are modified as follows:

Forced ventilation
only for (terminals 81/82)

Type of protection: Intrinsic Safety EEx ia IIC
connection to a certified intrinsically safe circuit

Maximum values:
Ui = 28 V
Ii = 115 mA

Li negligible
Ci = 5,3 nF

All the other electrical data and other data specified in the EC Type Examination Certificate apply also to this Addendum No. 2.

Test report: **PTB Ex 07-27260**

Zertifizierungsstelle Explosionsschutz

By order
(Signature) (Seal)
Dr.-Ing. U. Johannsmeyer
Director and Professor

Braunschweig, 24. August 2007

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Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

(1) **Statement of Conformity**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**

(3) EC Type Examination Certificate Number

PTB 05 ATEX 2010 X

(4) Equipment: Model 3730-48.. and 3730-58.. Positioners

(5) Manufacturer: SAMSON AG, Mess- und Regeltechnik

(6) Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

(7) The equipment and any acceptable variations thereof are specified in the schedule to this certificate.

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 in according to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres as specified in Annex II to the Directive.

The examination and test results are recorded in confidential report PTB Ex 05-24319.

(9) The Essential Health and Safety Requirements are satisfied by compliance with

EN 50021:1999 EN 50281-1-1:1998

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

Statement of conformity without signature and seal are invalid.
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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

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(11) In compliance with the Directive 94/9/EC this Statement of Conformity relates only to the design and construction of the equipment specified. Further requirements of this Directive apply to manufacture and marketing of the equipment.

(12) The marking of the equipment shall include the following:

II 3G EEx nA II T6 or II 3G EEx nL IIC T6 or
II 3D IP 54 T 80 °C or II 2D IP 65 T 80 °C

Zertifizierungsstelle Explosionsschutz Braunschweig, 16 February 2005
By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

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(13) **S c h e d u l e**

(14) **EC TYPE EXAMINATION CERTIFICATE No PTB 05 ATEX 2010 X**

(15) **Description of Equipment**

The Model 3730-48 and 3730-58.. Positioners are bus-powered field devices with communication capability and serve for translating control signals into valve stem positions. They are intended for attachment to linear or rotary actuators.

For instrument air non-combustible media are used.

The equipment is intended for use inside the hazardous locations.

The correlation between temperature classification, permissible temperature ranges is shown in the tables below:

Temperature class	Permissible ambient temperature range
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

Electrical data

BUS connection, signal circuit (terminals 11/12)

Type of protection: EEx nA II or Ex nL IIC resp.

Gas group	Maximum values
IIC	U_o = 20V; I_o = 464mA, P_o = 2,32W U_o = 24V; I_o = 261mA, P_o = 1,56W U_o = 30V; I_o = 152mA, P_o = 1,14W
IIB	U_o 20V; I_o 1,17A, P_o 5,88W U_o = 24V; I_o = 650mA, P_o = 3,89W U_o = 30V; I_o = 379mA, P_o = 2,85W

Ci = 5 nF; Li = 10 μH

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Braunschweig und Berlin

Inductive proximity switch (terminals 41/42)

Type of protection: EEx nA II or Ex nL IIC resp.

Maximum values

Ui = 20 V
Ii 52 A
Pi 169 W

Li = 100μH
Ci = 30nF

The correlation between temperature classification, the permissible ambient temperature ranges, the maximum short-circuit currents and the maximum power for analyzers is shown in the table below

Temperature class	Permissible ambient temperature range	I_o / P_o
T6	+45°C	
T5	-40°C ... +60°C	52mA / 169mW
T4	+75°C	
T6	+60°C	
T5	-40°C...+80°C	25mA / 64mW
T4	+80°C	

Forced venting function (terminals 81/82)

Type of protection: EEx nA II or Ex nL IIC/IIB resp.

Maximum values:

Ui = 30 V
Ii = 100 mA

Li = negligible
Ci = 5.3 nF

Binary input 1 (terminals 87 / 88)

Type of protection: EEx nA II or Ex nL IIC/IIB resp

Maximum values:

Ui = 30 V
Ii = 100 mA

Li = negligible
Ci = negligible

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Binary input 2
(terminals 85 / 86)

Type of protection: EEx nA II or Ex nL IIC/IIB resp.
only for connection of a floating passive contact circuit

Maximum values:

U_o = 5,88 V
I_o = 1 mA
P_o = 7,2 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
C_o = 1,8µF	C_o = 15,8µF
L_o = 9,7mH	L_o = 1H

C_i = negligible
L_i = negligible

Serial interface BU

Type of protection: EEx nA II or Ex nL IIC/IIB resp.

Maximum values (active):

U_o = 8,61 V
I_o = 55 mA
P_o = 250 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
C_o = 0,61µF	C_o = 4µF
L_o = 9mH	L_o = 9mH

Maximum values (passive):

U_i = 20V
I_i = 25mA
P_i = 64mW

L_i = negligible
C_i = negligible

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External positioner sensor
(analog PCB pins p9, p10, p11)

Type of protection: EEx nA II or Ex nL IIC/IIB resp.

Maximum values (active):

U_o = 8,61 V
I_o = 55 mA
P_o = 250 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
C_o = 0,61µF	C_o = 4µF
L_o = 9mH	L_o = 9mH

L_i = 370µH
C_i = 730nF

(16) Test Report: **PTB Ex 05-24319**

(17) **Special conditions for safe use**

(18) **Basic safety and health requirements**

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 16 February 2005

(Signature) (seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

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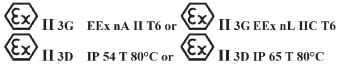
Braunschweig und Berlin

PTB

ADDENDUM No. 1

to the Statement of Conformity PTB 05 ATEX 2010 X

Equipment: Model 3730-48.. and 3730-58 Positioners

Marking:  **II 3G EEx nA II T6 or II 3G EEx nL IIC T6**
II 3D IP 54 T 80°C or II 3D IP 65 T 80°C

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Weismüllerstr. 3
60314 Frankfurt am Main

Description of the additions and modifications

The Model 3730-48.. and 3730-58.Positioners are permitted to be manufactured in the future also in compliance with the documents specified in the Test Report. The input wiring of the bus connection circuit has been modified and the pcb layout has been adapted.

The clause below supplements the description of the equipment under clause (15) Para. 2 of the EC Type Examination Certificate.

"BUS connection (coupling) can be made according to the FISCO Concept both for the Profibus PA and the Foundation ™ Fieldbus Specification."

The electrical data, special conditions and all the other data of the EC Type Examination Certificate continue to apply unaltered also to this Addendum No. 1.

Test report: PTB **Ex 06-26086**

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 13, July 2006

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Director and Professor

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Physikalisch-Technische Bundesanstalt – Bundesallee 100 - D 38116 Braunschweig

Installation Manual for apparatus certified by CSA for use in hazardous locations.
Communication is optionally either according to the FOUNDATION™ Fieldbus Specification or according to PROFIBUS PA in compliance FISCO-Concept

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage (V_{max}) the current (I_{max}) and the power (P_{max}) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (V_{OC}) the current (I_{SC}) and the power (P_O) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (C_i) and inductance (L_i) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.
In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system The allowed voltage (V_{OC}) of the associated apparatus is limited to the range of
14V DC. to 24V DC. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50mA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices need to have the parameters in the following range:

Loop resistance R':	15 ... 150 Ohm/km
Inductance per unit length L':	0,4 ... 1 mH/km
Capacitance per unit length C':	80 ... 200 nF/km
C' = C' line/line + 0,5 C' line/screen, if both lines are floating or, C' = C' line/line + C'line/screen, if the screen is connected to one line	
Length of spur cable:	≤ 30 m
Length of trunk cable:	≤ 1 km

At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:

R = 90 ... 100 Ohm	C = 0 ... 2,2 µF

One of the allowed terminations might already be integrated in the associated apparatus.

The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

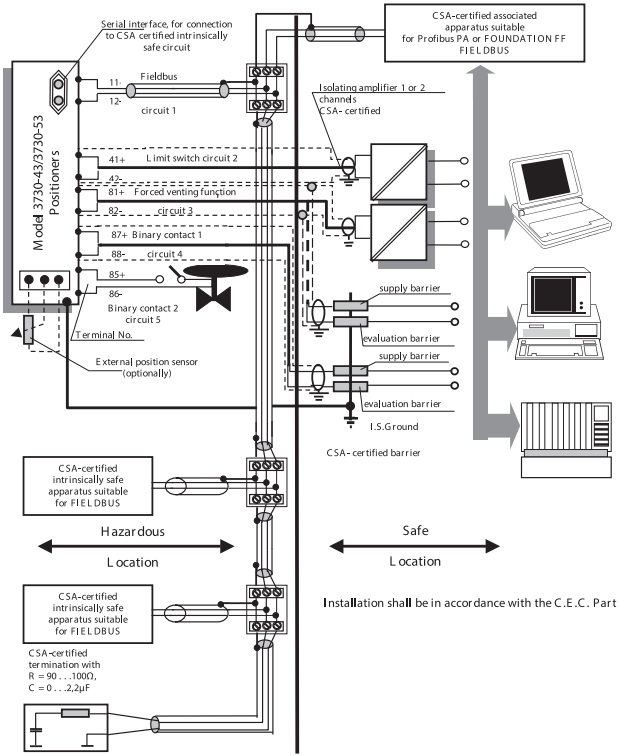
Notes:

1. Approved associated apparatus must be installed in accordance with manufacturer instructions
2. Approved associated apparatus must meet the following requirements:
   $V_{OC} \leq V_{max}$, $I_{SC} \leq I_{max}$, $P_O \leq P_{max}$
3. The maximum non-hazardous area voltage must not exceed 250 V.
4. The installation must be in accordance with the Canadian Electrical code Part 1.
5. Each set of wires must be provided with grounded shield. The shield must extend as close to the terminal(s) as possible and it must be grounded shield at I. S. Barrier ground.
6. Caution: Use only supply wires suitable for 5 °C above surrounding.
7. Warning: Substitution of components may impair intrinsic safety. PE = I. S. Ground
8. The polarity for connecting 11 and 12 is of no importance due to an internal rectifier.
9. FISCO concept applies to fieldbus / circuit only.
10. Entity parameters apply to circuit 2, 3 and 4 and further required to meet the following conditions:
    $C_o \geq C_i + C_{cable}$; $L_o \geq L_i + L_{cable}$

Intrinsically safe if installed as specified in manufacturer's installation manual.

CSA- certified for hazardous locations Type 4 Enclosure

Ex ia IIC T6
Class I, Division 1, Groups A, B, C and D; Class II, Division 1, Groups E, F + G; Class III.



Installation shall be in accordance with the C.E.C. Part 1

Table 1: Intrinsic Safety Parameters

	Fieldbus				Limit-switches inductive	Forced venting-function	Binary- input		Serial-Interface	
	Foundation		Profibus				1	2	Active	Passive
Circuit No.	1		1		2	3	4	5	6	6
Terminal No.	11 / 12 (IEC 1148-2)		11 / 12 (IEC 1148-2)		41 / 42	81 / 82	87 / 87	85 / 86	plug	
Groups	IIC	IIB	IIC	IIB	#/#	#/#	#/#	#/#	#/#	#/#
V_{max} [V]	24		17,5		16	28 30	28 30	###	###	16
U_0 or V_{OC}	##							5,88V	8,61V	###
I_{max} [mA]	360	380	380		25 52	115 100	115 100	###	###	25
I_0 or I_{SC}	##							1mA	55mA	###
P_{max} [W]	1,04	2,58	5,32		64mW 169mW	##	##	7,2 mW	250 mW	64 mW
C_i [nF]	2				60	5,3	0	###	###	0
C_0 or C_a	##							2µF	0,61µF	###
L_i [µH]	10				100	0	0	###	###	0
L_0 or L_a	##							10mH	9mH	###

Binary- input 1: For connection of an active signal circuit

Binary- input 2: For connection of an passive contact circuit directly on the control valve, e.g. passive pressure switch for leakage monitoring

Notes:

1. Entity parameters must meet the following requirements:

   $V_{OC} \leq V_{max}$, $I_{SC} \leq I_{max}$, $P_0 \leq P_{max}$
   C_0 or $C_a \geq C_i + C_{cable}$ and L_0 or $L_a \geq L_i + L_{cable}$

2. Install in accordance with the Canadian Electrical Code Part I

3. Cable entry M 20 x1,5 or metal conduit acc. to dwg. No. 1050-0540

* Circuit 3 can be connected to a CSA Certified zener barrier that is rated as follows:
- Supply channel (connect to Terminal 81): Voc ≤ 28V max. and Rmin ≥ 245 Ω
- Return channel (connect to Terminal 82): ≤ 28V max with diodes Return (zero current)

** Circuit 4 can be connected to a CSA Certified zener barrier that is rated as follows:
- Supply channel (connect to Terminal 87): Voc ≤ 30V and Rmin ≥ 300 Ω
- Return channel (connect to Terminal 88): Voc ≤ 30V max with diodes Return (zero current)

Table 2: CSA – certified barrier parameters of circuit 4

Barrier	Supply barrier		Evaluation barrier	
	V_{OC}	R_{min}	V_{OC}	R_{min}
circuit 3	≤28V	≥245Ω	≤28V	Diode
circuit 4	≤30V	≥300Ω	≤30V	Diode

The correlation between temperature classification and permissible ambient temperature ranges is shown in the table 3 below:

Table 3:

Temperature class	Permissble ambient temperature range
T6	+60°C
T5	-40°C ≤ T_a ≤+70°C
T4	+80°C

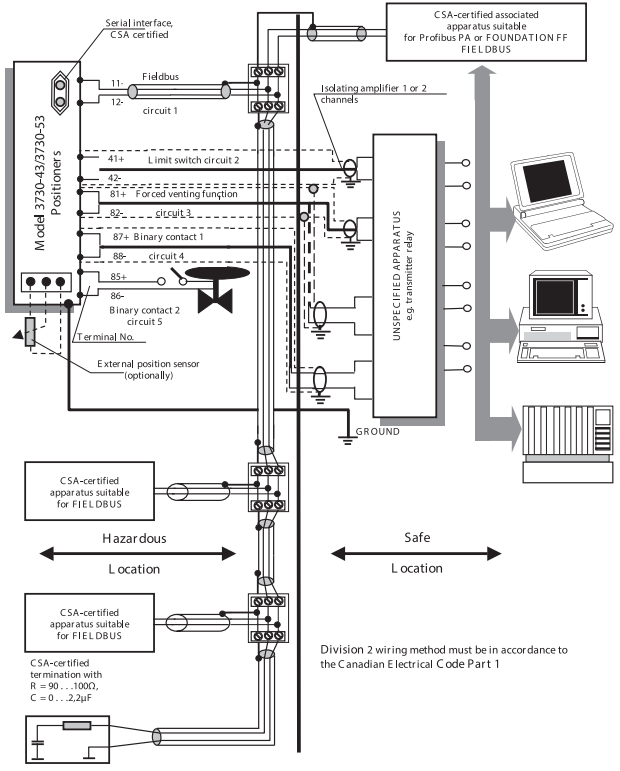
Table 4: Energy-Limited (Non- Incendive) Parameters

	Foundation Fieldbus or Profibus PA (Non incendive Equipment)								Limit-switches (inductive)	Forced venting function	Binary-Input 1	Maximum values for serial-interface and binary input 2 see table 1
Terminal	11 / 12 (IEC 1148-2)								41 / 42	81 / 82	87 / 88	
Groups	A, B and IIC				C, D and IIB				#/#	#/#	#/#	
U_i or V_{max} [VDC]	20V	24V	30V	32V	20V	24V	30V	32V	20V	28V 30V 32V	28V 30V 32V	
I_i or I_{max} [mA]	464	261	152	130	1,117 A	650	379	324	25mA 52mA	115mA 100mA 90mA	115mA 100mA 90mA	
P_i or P_{max} [W]	2,32	1,56	1,14	1,14	5,88	3,89	3,85	2,77	64mW 169mW	##	##	
C_i	2nF								30	5,3	0	
L_i	10µH								100	0	0	

CSA certified for hazardous locations:

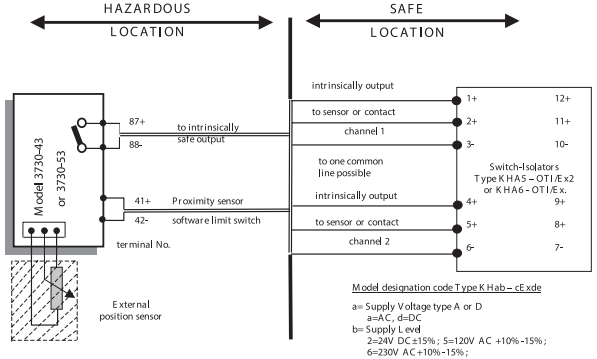
Ex nA II T6 / Ex nL IIC T6
Class I, Div. 2; Groups A, B, C, D; Class II, Div. 2 Groups E, F + G; Class III

Type 4 Enclosure



Division 2 wiring method must be in accordance to the Canadian Electrical Code Part 1

Installation drawing Control Relay KHA5-OTI/Ex2, KHA6-OTI/Ex1 or KHA6-OTI/Ex2 with Model SJ-b-N Proximity Sensors



Model designation code Type KHab – cExde

a= Supply Voltage type A or D
a=AC, d=DC
b= Supply Level
2=24V DC±15% ; 5=120V AC +10%-15% ;
6=230V AC+10%-15% ;
c= Output type RTA/; RW1/; SS1/; SS2/; RS1/; SR/; ST-or SOT
d= Number of channels 1 or 2
e= Power rail designation, P, 2S.P or GS.P (includes Model KHD2-EB-PB Power Feed Module) or Blank

The total series inductance and shunt capacitance of shield wiring shall be restricted to the following maximum values

maximum capacitance of each inductive sensor 30nF
maximum inductance of each inductive sensor 100µH

System parameters

Control Relay Terminal No.	Groups	L [mH]	C [µF]	V_{OC} [V]	I_{SC} [mA]	V_{max} [V]	R_{min} [Ω]
1-3; 2-3 4-6; 5-6	A + B	192	2,66	10,5	13	10,5	811
	C + E	671	7,9				
	D, F, G	1000	21,3				

Division 2 wiring method shall be in accordance to the Canadian Electrical Code Part 1.

Installation Manual for apparatus approved by FM for use in hazardous locations.
Communication is optionally either according to the FOUNDATION™ Fieldbus Specification or according to PROFIBUS PA in compliance FISCO-Concept

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage (V_{max}/U_i) the current (I_{max}/I_i) and the power (P_i) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (V_{oc}/U_o) the current (I_{sc}/I_o) and the power (P_o) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (C_i) and inductance (L_i) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.
In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system The allowed voltage (V_{oc} /U_o) of the associated apparatus is limited to the range of 14V DC. to 24V DC. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50mA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices need to have the parameters in the following range:

Loop resistance R':	15 ... 150 Ohm/km
Inductance per unit length L':	0,4 ... 1 mH/km
Capacitance per unit length C':	80 ... 200 nF/km

C' = C' line/line + 0,5 C' line/screen, if both lines are floating or, C' = C' line/line + C'line/screen, if the screen is connected to one line

Length of spur cable:	≤ 30 m
Length of trunk cable:	≤ 1 km

At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:

R = 90 ... 100 Ohm	C = 0 ... 2,2 µF

One of the allowed terminations might already be integrated in the associated apparatus.

The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

Notes:

1. Approved associated apparatus must be installed in accordance with manufacturer instructions
2. Approved associated apparatus must meet the following requirements:

   Uo or Voc ≤ Ui or Vmax, Io or Isc ≤ Ii or Imax, Po ≤ Pi or Pmax
3. The maximum non-hazardous area voltage must not exceed 250 V.
4. The installation must be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01
5. Each set of wires must be provided with grounded shield. The shield must extend as close to the terminal(s) as possible and it must be grounded shield at I. S. Barrier ground.
6. Caution: Use only supply wires suitable for 5 °C above surrounding.
7. Warning: Substitution of components may impair intrinsic safety. PE = I. S. Ground
8. The polarity for connecting 11 and 12 is of no importance due to an internal rectifier.
9. FISCO concept applies to fieldbus / circuit only.
10. Entity parameters apply to circuit 2, 3 and 4 and further required to meet the following conditions:

    Co ≥ Ci + Ccable; Lo ≥ Li + Lcable

Intrinsically safe if installed as specified in manufacturer's installation manual.

FM- approved for hazardous locations

Class I, Zone 0 AEx ia IIC T6:
Class I, II, III Div. 1, Groups A, B, C, D, E, F + G. Field enclosure NEMA 4X

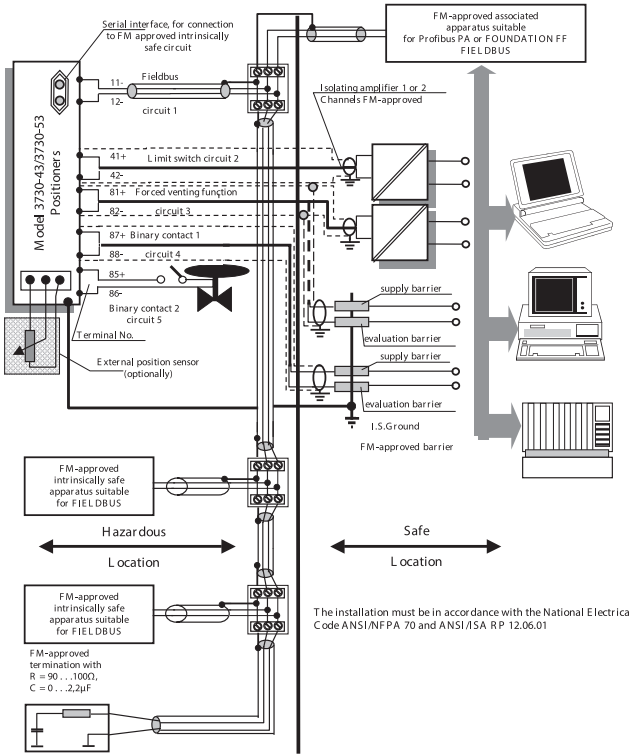


Table 1: Maximum values

	Fieldbus			Limit-switches inductive	Forced venting-function	Binary- input		Serial-Interface	
	Foundation		Profibus			1	2	active	passive
Circuit No.	1		1	2	3	4	5	6	6
Terminal No.	11 / 12		11 / 12	41 / 42	81 / 82	87 / 88	85 / 86	plug	
Groups	A, B IIC	C, D IIB	A, B, C, D IIC / IIB	#/#	#/#	#/#	#/#	#/#	#/#
U_i or V_{max} [V]	24		17,5	16	28	30	V_{OC} 5,88	V_{OC} 8,61	V_{max} 16
I_i or I_{max} [mA]	360	380	380	25	115	100	I_{SC} 1	I_{SC} 55	I_{max} 25
P_i or P_{max} [W]	1,04	2,58	5,32	64 mW	##	##	7,2 mW	250 mW	64 mW
C_i [nF]	5			60	5,3	0	2µF	0,61µF	0
L_i [µH]	10			100	0	0	10mH	9mH	0

Binary- input 1: For connection of an active signal circuit

Binary- input 2: For connection of an passive contact circuit directly on the control valve, e.g. passive pressure switch for leakage monitoring

Notes:

1. Entity parameters must meet the following requirements:

   $U_0 \leq U_i$ or V_{max}, $I_0 \leq I_i$ or I_{max}, $P_0 \leq P_i$ or P_{max}
   C_0 or $C_a \geq C_i + C_{cable}$ and L_0 or $L_a \geq L_i + L_{cable}$

2. The installation must be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01

3. Cable entry M 20 x1,5 or metal conduit acc. to dwg. No. 1050-0540

Table 2: FM – approved barrier parameters of circuit 4

Barrier	Supply barrier				Evaluation barrier	
	V_{OC}	R_{min}	I_{OC}	P_{max}	V_{OC}	R_{min}
circuit 3	≤28V	≥245Ω	≤115mA	##	≤28V	Diode
circuit 4	≤30V	≥300Ω	≤100mA	##	≤30V	Diode

The correlation between temperature classification and permissible ambient temperature ranges is shown in the table 3 below:

Table 3:

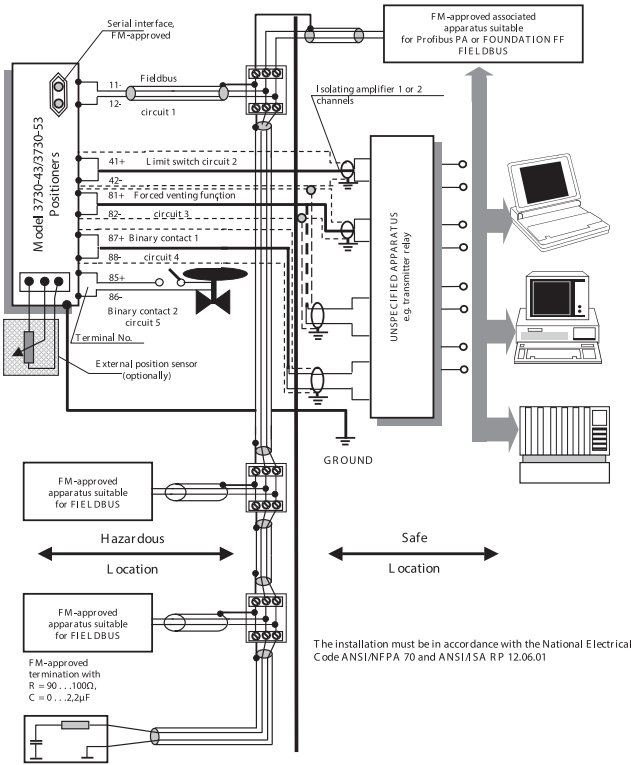
Temperature class	Permissble ambient temperature range
T6	+60°C
T5	-40°C ≤ T_a ≤+70°C
T4	+80°C

Table 4:

	Foundation Fieldbus or Profibus PA (Non incendive Field wiring)								Limit-switches (inductive)	Forced venting function	Binary-Input 1	Maximum values for serial-interface and binary input 2 see table 1
Terminal	11 / 12								41 / 42	81 / 82	87 / 88	
Groups	A, B and IIC				C, D and IIB				#/#	#/#	#/#	
U_i or V_{max} [VDC]	20V	24V	30V	32V	20V	24V	30V	32V	20V	30V	30V	
I_i or I_{max} [mA]	464	261	152	130	1,117 A	650	379	324	25mA	100mA	100mA	
P_i or P_{max} [W]	2,32	1,56	1,14	1,14	5,88	3,89	3,85	2,77	64mW	##	##	
C_i	5nF								60	5,3	0	
L_i	10µH								100	0	0	

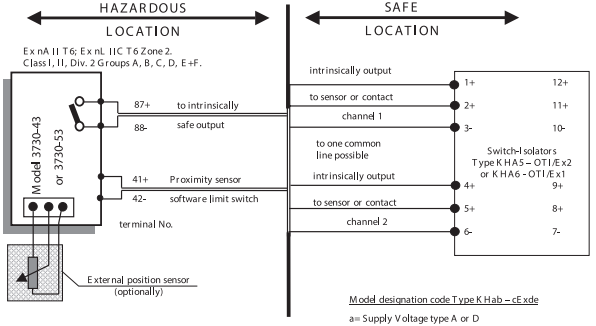
FM approved for hazardous locations:
Ex nA II T6; Ex nL IIC T6 Zone 2.
Class I, II, Div. 2 Groups A, B, C, D, E+F.

Field enclosure NEMA 4X



The installation must be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01

Installation drawing Control Relay KHA5-OTI/Ex2, KHA6-OTI/Ex1 or KHA6-OTI/Ex2 with Model SJ-b-N Proximity Sensor



maximum capacitance of each inductive sensor 30nF
maximum inductance of each inductive sensor 100µH

Model designation code Type KHab – cExde

a= Supply Voltage type A or D
a=AC, d=DC
b= Supply Level
2=24V DC±15%; 5=120V AC +10% -15%;
6=230V AC+10% -15%;
c= Output type RTA/; RW1/; SS1/; SS2/; RS1/; SR/; ST-or SOT
d= Number of channels 1 or 2
e= Power rail designation, P, 2S.P or GS.P (includes Model KHD2-EB-PB Power Feed Module) or Blank

Each pair of I.S. wires must be protected by a shield that is grounded at the I.S. Ground. The shield must be extend as close to the terminals as possible installation shall be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01.

The total series inductance and shunt capacitance of shield wiring shall be restricted to the following maximum values

System parameters

Control Relay Terminal No.	Groups	L [mH]	C [µF]	Voc [V]	Isc [mA]	Vmax [V]	Rmin [Ω]
1-3; 2-3 4-5; 5-6	A + B	192	2,66	↑	↑	↑	↑
	C + E	671	7,9	10,5 ↓	13 ↓	↓	↓
	D, F, G	1000	21,3				

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